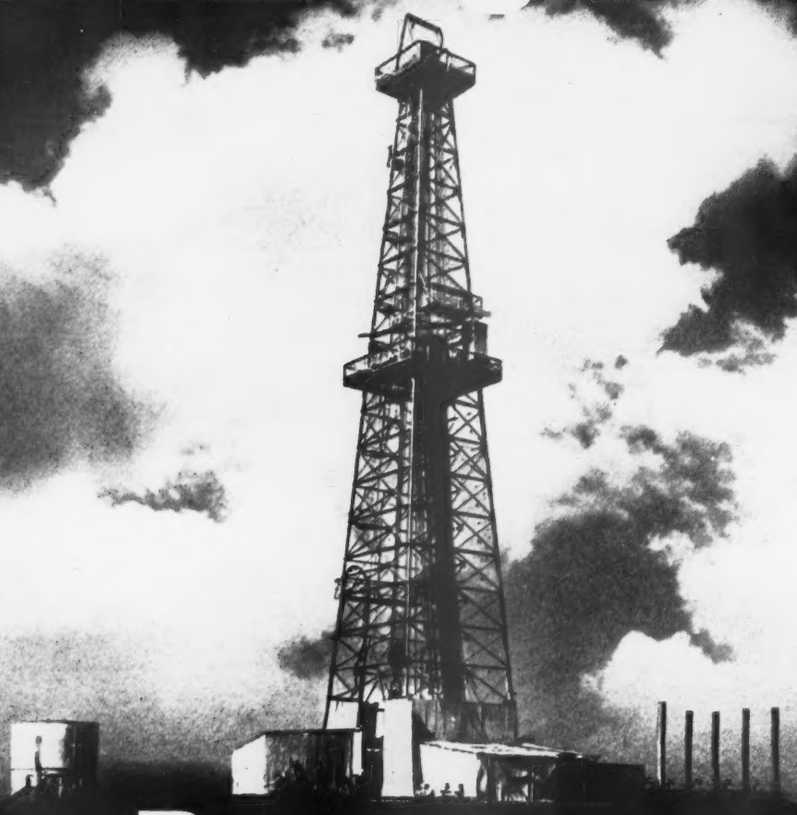
331.05
F112

BILLINGS LIBRARY
University of Vermont

DEC - 6 1939

143.862

FROM A WELL IN OKLAHOMA.....



to a PUMP in YOUR HOME TOWN

SYNTHANE KEEPS UPKEEP DOWN

____an example YOU can profit by

Your business may have no relation to the oil industry. Yet the variety of oil industry uses for Synthane Bakelite-laminated may readily suggest a profitable application to you.

Synthane's service to the oil industry starts with the instruments for locating oil-bearing strata; and doesn't stop until it reaches the "gas" pump in your home town. You'll find Synthane Bakelite-laminated in the whole cycle from well to customer.

Nitroglycerin explosives containers for shooting wells are made of Synthane. Pipeline valves contain Synthane parts. Booster pumps have Synthane piston rings and rod packing. Synthane is used in refinery pumps and valves. It prevents electrolysis between refinery tanks and pipe lines. Synthane gears and vanes are probably in the pump at your favorite service station—and if you care to look—in parts of the oil burner in your own home.

Synthane's resistance to corrosion from oil, plus a broad combination of other properties, is responsible for the repeated use of Synthane by all branches of the oil industry.

Synthane resists corrosion from many acids, salts, solvents and water. It is structurally strong, light in weight, one of the best of electrical insulators and easily machined. It may be just the material—for a combination of reasons—you are looking for. Our laboratory will help you find out; our fabricating department will machine it—if you desire—to your specifications.

MAIL THIS COUPON TODAY

Synthane Corporation, Oaks, Pa. Please send me further information about Synthane for:

_____

☐ Ask your representative to get in touch with me.

Name_____

Address_____

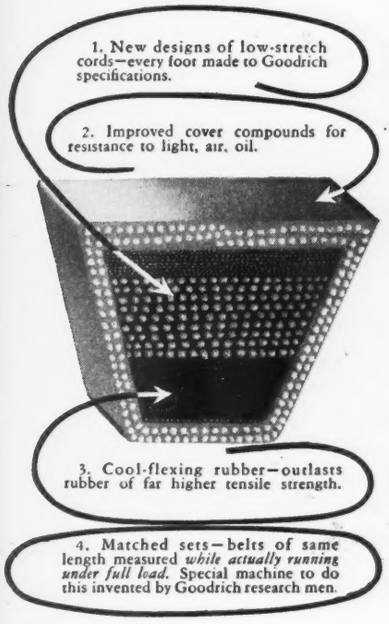
SYNTHANE

Bakelite- *laminated*

SHEETS · RODS · TUBES · FABRICATED PARTS · SILENT STABILIZED GEAR MATERIAL

SYNTHANE CORPORATION · OAKS, PENNSYLVANIA

Recent Improvements in Goodrich V-Belts


1. New designs of low-stretch cords—every foot made to Goodrich specifications.
2. Improved cover compounds for resistance to light, air, oil.
3. Cool-flexing rubber—outlasts rubber of far higher tensile strength.
4. Matched sets—belts of same length measured *while actually running under full load.* Special machine to do this invented by Goodrich research men.

"Pole Peeler" shock load snaps all belts tried except Goodrich

. . . Interesting machine is extraordinary test of V-Belt strength and stamina

TREES destined for use as fence-posts or telegraph poles have to be "peeled"—the bark cut off and the wood trimmed to uniform diameter or tapering shape. Ingeniously arranged knives, driven by V-Belts, do the job.

But imagine the shock load to the belts when those whirling knives engage the heavy log! Belt after belt was used—and instantly snapped. Finally Goodrich tension-matched V-Belts were tried. Instead of lasting for seconds, they worked for months. The machine maker has standardized on Goodrich—sends out all his machines equipped with them, and advises his customers to insist on Goodrich V-Belts *matched under operating tension.*

Here's why this Goodrich feature is important to every user of V-Belts (and it is only one of many values in Goodrich Belts that can save money for you, too).

Tension-matched V-Belts

No matter how carefully measured and matched a set of V-Belts may be, put them to work and some will stretch more than others. These longer belts then idle, slip, wear out more quickly. Goodrich invented a machine which measures belts under operating tension. Sets can then be made up only of belts of equal length which will operate as a team—each pulling its full share, and all wearing longer.

Cool-running rubber

Here's another Goodrich advantage. Goodrich engineers have developed a special rubber compound for Goodrich V-Belts which runs 75% cooler than old compounds. Internal heat destroys belts just as it does tires. This cool-running Goodrich rubber is another important reason why Goodrich belts last so much longer, serve you better. The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio.

Goodrich

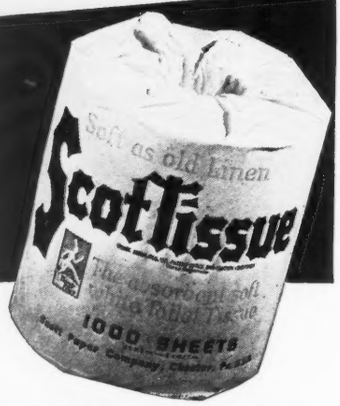
cool-running, tension-matched

V-Belts

TWENTY-FOUR HOURS A DAY

FOR FOURTEEN YEARS . . .

. . . and NO MAINTENANCE



Motorized Helical Gear Reducer
Worm Gear Reducer
OTHER LINK-BELT POSITIVE DRIVES INCLUDE:
Silverlink Roller Chain Drive
Silverstreak Silent Chain Drive
P.I.V. Gear and V.R.D. Variable Speed Units

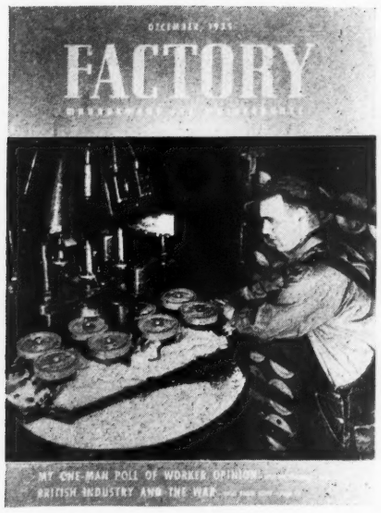
● What makes "Thirsty Fibre" such an old softy? Maybe the constant beating he gets. You'd think such service would be tough on paper mill equipment, but this Link-Belt herringbone gear speed reducer at the Scott Paper Co's mill, Chester, Pa., wouldn't know. It was called into service back in '25 and has been at it ever since, twenty-four hours a day, except for two stops: in 1931 the beater shaft needed realining and in 1936 old oil was cleaned out and new added. But the speed reducer wasn't touched. Its bearings and gears have required no attention.

This is another example of Link-Belt carefree service, the sort of performance industry has learned to expect from Link-Belt speed reducers. In addition to herringbone gear reducers, Link-Belt offers worm gear and motorized helical gear reducers, in a variety of sizes, ratios and horse powers. No doubt, one or more of the Link-Belt positive drives illustrated will meet your requirements.

Send for catalogs. Address: Link-Belt Company, Philadelphia, Chicago, Indianapolis, Atlanta, San Francisco, Toronto. Offices in principal cities.

7877

LINK-BELT
SPEED REDUCERS



Another glimpse of industry is shown in Number 12 of Factory's series of full-color covers. As the great automobile plants swing into full production of 1940 models, they make work for this drill-press operator in the Bridgeport, Pa., plant of Continental-Diamond Fibre Company. The golden disks are Celoron (a molded plastic fabric-base material) timing gear blanks, which play an important role in assuring the quietness of operation so essential to modern automotive engineering. Kodachrome by a McGraw-Hill staff photographer.

●

A. M. STAEHLE, *PUBLISHER*
L. C. MORROW, *EDITOR*

G. A. VAN BRUNT, LEWIS K. URQUHART
Associate Editors

J. F. ANDREWS, CHARLES B. COATES
Assistant Editors

A. H. MOGENSEN, ARTHUR VAN VLISSINGEN
Consulting Editors

H. P. DUTTON, *Chicago* C. B. GORDY, *Detroit* PAUL WOOTON, *Washington*

Factory Management and Maintenance is a consolidation of *Factory and Industrial Management* (including *"Factory"*) and *Maintenance Engineering*.

Price 35c a copy. Subscription rates—United States, Canada, Mexico, and Central and South American countries, $3 a year. All other countries $4 a year or 24 shillings. Cable address "McGrawhill, New York." Member A.B.P. Member A.B.C. Copyright, 1939, by McGraw-Hill Publishing Co., Inc.

Factory Management and Maintenance, December, 1939, Vol. 97; No. 12. Published monthly, McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42nd Street, New York, N. Y. Entered as second class matter, November 13, 1936, at Post Office, Albany, N. Y., U.S.A. under the Act of March 3, 1879. *Branch Offices:* 520 North Michigan Ave., Chicago; 68 Post St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.

McGRAW-HILL PUBLISHING CO., INC.

JAMES H. MCGRAW
Founder and Honorary Chairman

JAMES H. MCGRAW, JR., *President* HOWARD EHRLICH, *Executive Vice-President*

MASON BRITTON, *Vice-Chairman* B. R. PUTNAM, *Treasurer*

D. C. MCGRAW, *Secretary* J. E. BLACKBURN, JR., *Director of Circulation*

A McGRAW-HILL PUBLICATION

FACTORY

MANAGEMENT and MAINTENANCE

DECEMBER, 1939

Jobs to Be Done in 1940 ..... *L. C. Morrow* 35

My One-Man Poll of Worker Opinion .... *Whiting Williams* 36

British Industry and the War ..... *Ursel Baliol Scott* 39

Payroll Reporting Made Easy ..... *Eugene Caldwell* 44

Organized for Welding ..... *W. V. Emery* 46

Setting Time Standards When Machine Times Vary ..... *C. B. Carr* 48

The ABC's of Personnel ..... *Charles S. Stevenson* 51

Budgeting Inventories and Stabilizing Employment ..... *P. K. Poulton and P. H. Goldsmith* 52

Motion Study Research ..... *Ralph M. Barnes and Marvin E. Mundel* 56

Management Shorts 59

Cut Heating Costs by Filtering and Recirculating Air . . . What Will Your Maintenance Budget Call for? . . . A Maintenance Dollar Scrimped May Cost Two in Fires .... editorials 62

Electrical Instruments: First Aid for Maintenance and Production ..... *W. H. Ruehlin* 63

Seven Jobs Simplified With Portable Electric Tools 66

Maintenance Is a Job for Specialists ..... *G. W. Donovan* 68

Halves Chip Disposal Cost ..... *Glen Johnson* 70

Safety and Ease in Pushbutton Control 72

Capacitor Motors—a Safe Bet ..... *E. P. Codling* 74

Maintenance Service Shorts 76

Data Sheets: How to Prevent Freeze-Ups in Fire Protection Equipment 79

You Want to Know 82

What's New in Equipment 84

Books 128

Calendar 130

Catalog Service 135

"WE'VE PEPPED UP PRODUCTION

since we adopted

GULF'S HIGHER QUALITY OILS!..

. . . and still keep the maintenance-cost curve on the decline,"

. . . SAY LEADING PLANT OPERATORS.

"WE'RE being rewarded for the sound lubrication policy we adopted last year," says this operating official. "Now with production stepped up, we're having no mechanical difficulties and are enjoying still lower costs for maintenance. It has paid us to put the Gulf engineer's recommendations into practice."

Without further delay, you can put into operation in your plant a modern lubrication procedure that will insure you against the hazards of mechanical difficulties and losses which often accompany increased production schedules.

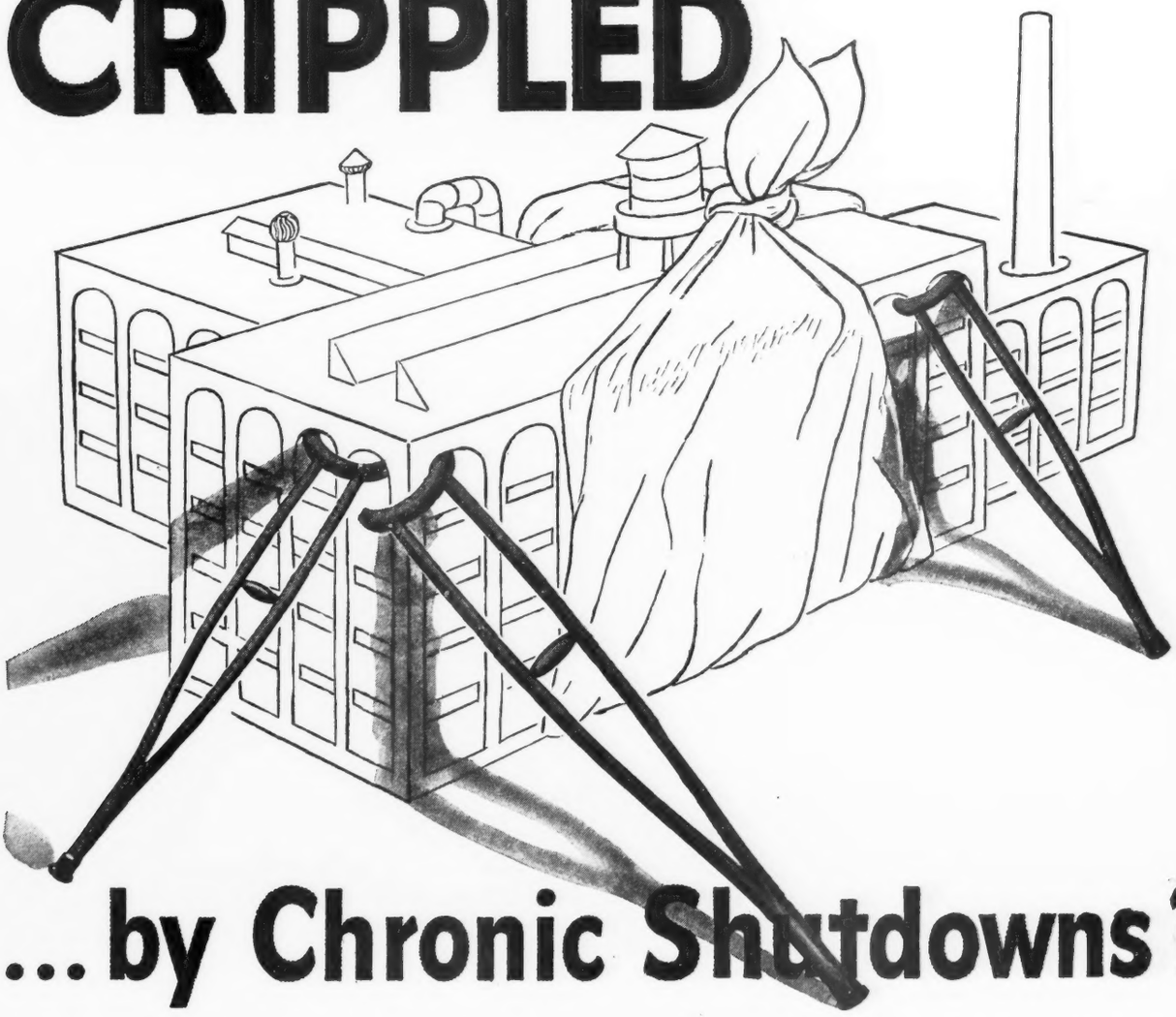
Ask the Gulf engineer who calls on you to work with your operating men toward the attainment of more efficient lubrication for all your equipment. His recommendations are based on sound knowledge and broad experience in the lubrication of equipment similar to yours. Gulf Oil Corporation, Gulf Refining Company, Pittsburgh, Pa.

GULF INDUSTRIAL LUBRICATION

To Maintain Quality . . .

. . . GULF RESEARCH MEN continually test lubricants with a wide variety of specially designed equipment. Oils and greases are subjected to a wider range of operating conditions than are encountered in actual service. Thus Gulf's engineers are able to recommend lubricants which not only meet the prevailing conditions, but provide an *extra margin of safety!*

CRIPPLED



... by Chronic Shutdowns?

SHUTDOWNS seldom close factory doors. But every shutdown ... no matter how small ... runs up costs. In the course of a year many small shutdowns cripple factory efficiency to a much greater extent than is realized.

"It's part of the game—you can't avoid it," said one factory man.

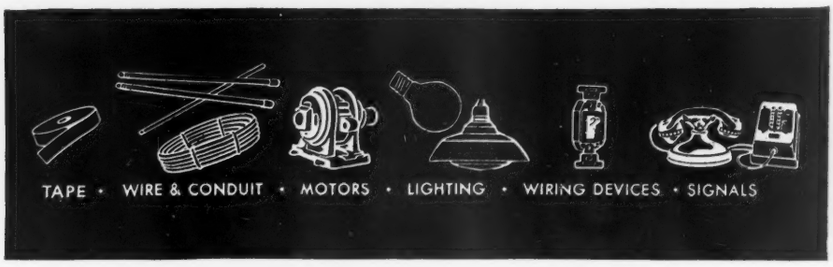
But *is* it?

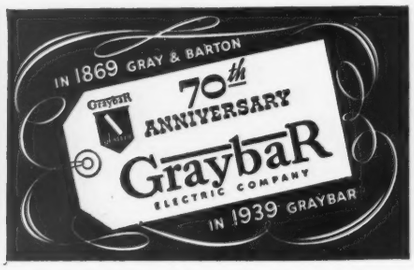
In some industries—industries in which an uninterrupted flow of production is vitally important—shutdowns have been almost entirely eliminated. The same should be possible in *your* factory.

For Chronic Shutdowns ... a motor here ... an overloaded circuit there ... quick first aid is available. At the same time you can *prevent* shutdowns in the future.

When an electrical shutdown does come, call in your Electrical Contractor or—if you do your own installing—call your nearby Graybar warehouse. Graybar truck delivery will bring you the replacement products you need promptly.

Or better yet—you can *prevent* future breakdowns by checking up on your wiring now—and by replacing inadequate equipment with *dependable* materials from Graybar. Experienced Graybar men can offer helpful advice. Call in Graybar—today.

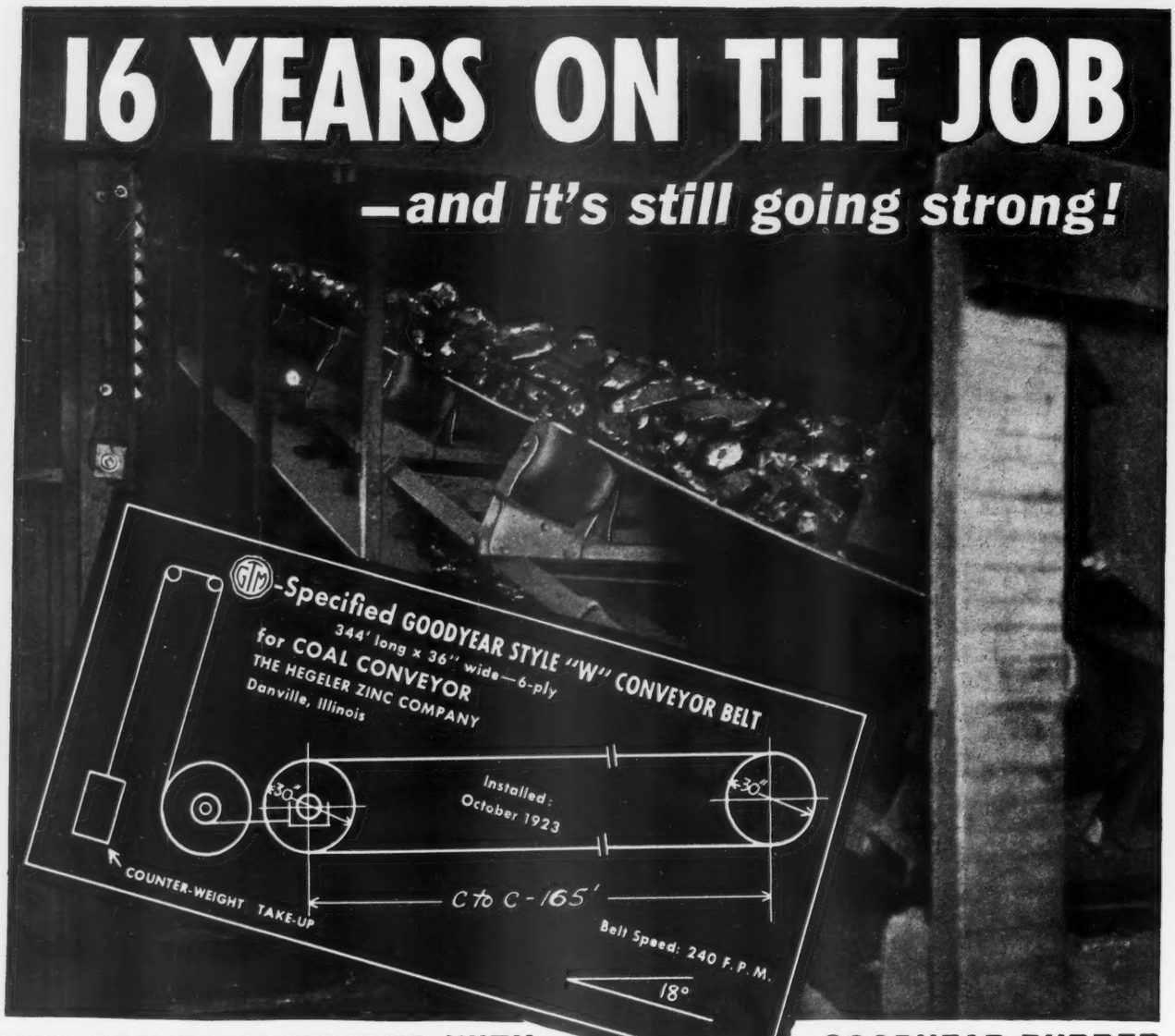




OFFICES IN 83 PRINCIPAL CITIES • EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK

16 YEARS ON THE JOB

—and it's still going strong!



YOU CAN DO IT BETTER WITH GOODYEAR RUBBER

IF YOU have ever had a conveyor belt fail prematurely from the effects of mildewing—the cancerous soft spots that rot through the carcass in mine operations where there is considerable "stand-by" time—you can profit from the following case history:

In 1923 The Hegeler Zinc Company of Danville, Illinois, needed a new belt for their coal conveyor running from the company's mine to the furnaces and called in the G.T.M.—Goodyear Technical Man. Finding that this belt would operate only 4 to 6 hours daily, four or five days a week—*standing by the rest of the time*—the G.T.M. specified a Style "W" conveyor belt built with Goodyear's exclusive mildew-inhibiting friction.

This belt is still in operation today—after 16 years of service in which it has handled well over a million tons of coal. It has never required any repairs or maintenance expense. It shows no sign of mildew attack—despite the high percentage of "stand-by" time—and is still in good condition.

This special mildew-resisting construction is only one reason why Goodyear conveyor belts hold the world's tonnage records in handling both anthracite and bituminous coal—*why they give lowest cost-per-ton service!* To get the full story from the G.T.M., write Goodyear, Akron, Ohio, or Los Angeles, California—or phone the nearest Goodyear Mechanical Rubber Goods Distributor.

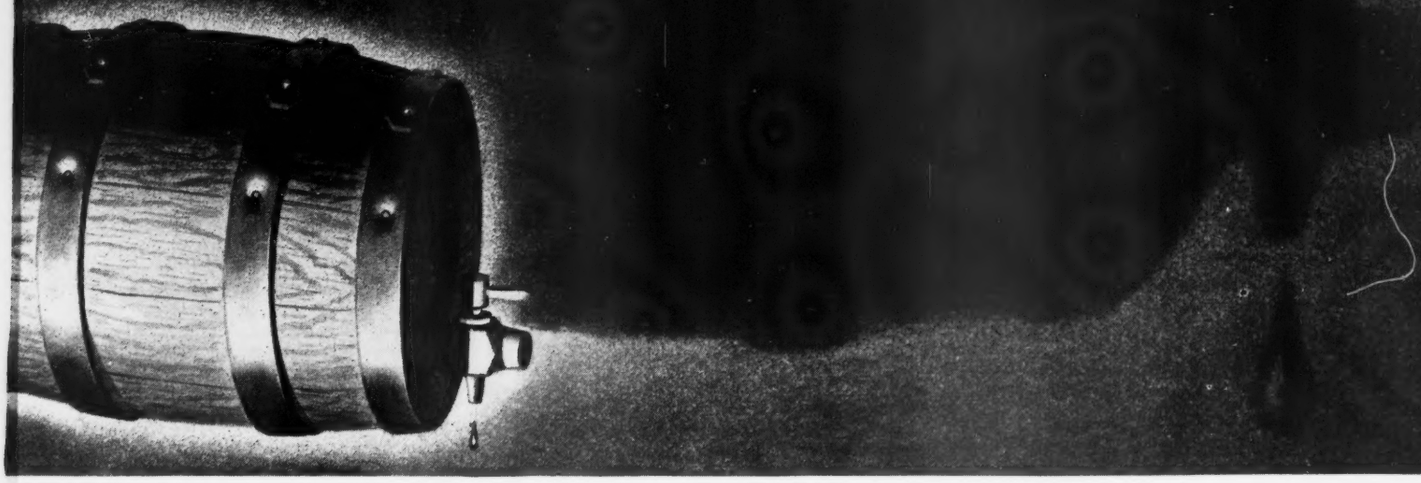
Centennial of Charles Goodyear's discovery of vulcanization

THE GREATEST NAME IN RUBBER

GOODYEAR

LITTLE LEAKS

can cause large losses



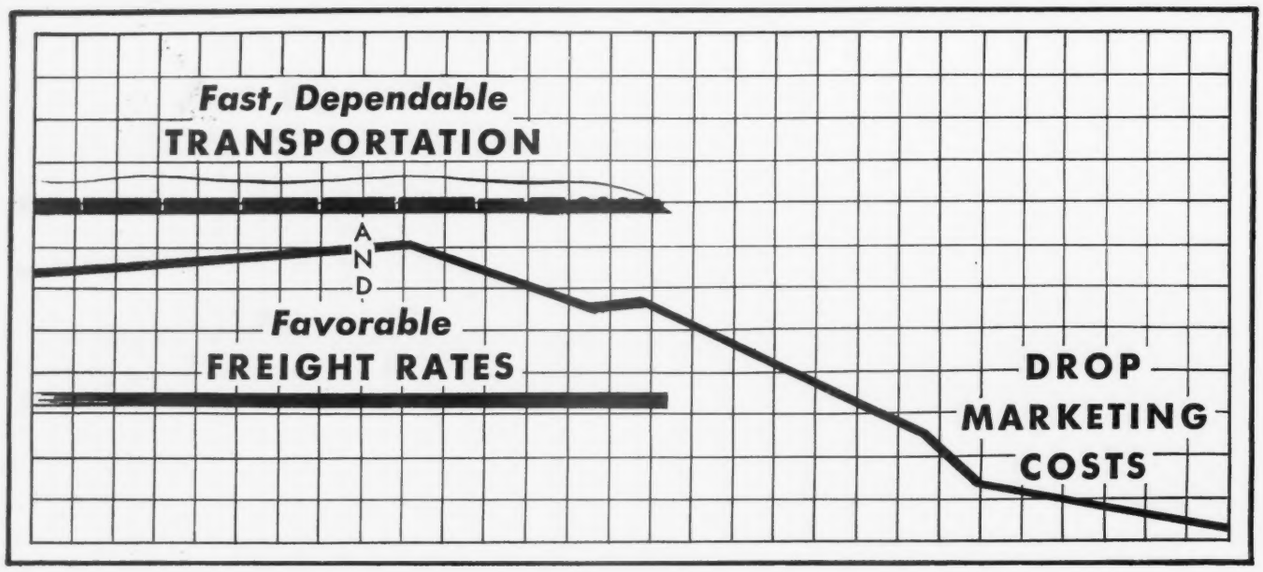
Stop "Brush leaks" with Osborn Brushes

OSBORN BRUSHES
Serving All Industries

Paint and Varnish Brushes
Wire Wheel Brushes
Fibre Wheel Brushes
Wire Scratch Brushes
Floor Sweeping Brushes
Window Cleaning Brushes
Counter or Bench Dusters
Fibre Push Brooms
Wire Push Brooms

Drip . . . drip . . . drip. Gallons can be lost by a little leak . . . 'til some one SEES it and stops it. • You can't SEE "brush leaks." But countless hours are wasted by workers using wrong brushes, poor brushes, badly worn brushes. • THINK of this needless waste! Don't push brushes aside as "unimportant." Brushes are TOOLS! Make sure that every brush used in your plant is a GOOD TOOL, *in good condition, right for its job!* • Osborn and the Osborn Brush Distributor near you can help YOUR company STOP BRUSH LEAKS! *Ask about it.*

THE OSBORN MANUFACTURING COMPANY • 5401 Hamilton Avenue, Cleveland, Ohio
SALES OFFICES: NEW YORK • DETROIT • CHICAGO • SAN FRANCISCO



...and Industry enjoys

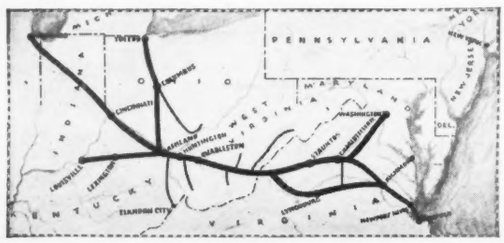
EXCELLENT TRANSPORTATION FACILITIES

in Chesapeake and Ohio Territory

Speed, favorable freight rates and dependable service are essential factors in the economics of marketing. Chesapeake and Ohio Lines—"The Road that Service Built"—has an enviable reputation among shippers in its territory: Virginia, West Virginia, Kentucky, Ohio and Indiana.

Running east and west through the heart of these states, Chesapeake and Ohio rails bring key cities of the east, midwest and south within first to third morning delivery of almost any point in the territory. Numerous strategic connections with other major railroads facilitate rapid delivery to any point in the United States. Heavy traffic and scheduled merchandise freight of every sort make demands on Chesapeake and Ohio service—demands which are scrupulously met by intelligent personnel operating a railroad plant and equipment second to none.

A great variety of industries have found that location in Chesapeake and Ohio Territory has lowered their production costs; for, besides excellent transportation, this region provides available industrial sites, easy access to raw materials, abundant native-born labor, cheap power and the benefits of business-minded legislation.



THESE ADVANTAGES

are but the fundamentals of many favorable conditions making Chesapeake and Ohio Territory an economic field of operation for many industries.

- RAW MATERIALS of many kinds; abundant, near at hand, economically secured.
- INTELLIGENT LABOR—native-born; largely skilled in a diversity of industries; well housed; peaceful and cooperative.
- NEAR TO MARKETS—major consuming areas within first, second or third morning delivery.
- EXCELLENT TRANSPORTATION—favorable freight rates and dependable service keep markets and manufacturers in economically close touch.
- CHEAP POWER—abundant coal, oil, natural gas and hydro-electric developments assure this region of unlimited power at most economical costs.
- COOPERATIVE LEGISLATION—Industry is king in Chesapeake and Ohio Territory, and the legislatures of the five great States in which it lies are friendly toward the needs and aims of enterprises they invite and those they already have.

What do you seek in a more advantageous location? Complete and impartial factual surveys for your specific industry will be furnished on request. All inquiries will be held in strictest confidence. Write

GEORGE D. MOFFETT, *Industrial Commissioner*
CHESAPEAKE AND OHIO LINES, Huntington, W. Va.

CHESAPEAKE *and Ohio* LINES

8½ YEAR REPAIR BILL

FOR 119 LO-MAINTENANCE MOTORS

$00.00!

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

Read the Sensational Performance Story of 119 Lo-Maintenance Motors . . . How They Ran Continuously for 8½ Years . . . With No Shut-Downs . . . and Not One Cent for Repairs! Get the Facts on the Full Measure Protection You Get with Allis-Chalmers Motors . . . on the Savings It Means To You!

Lo-Maintenance Motors keep production steady — without running up repair bills at the Lockwood Mfg. Co., Cincinnati, Ohio.

Here's a story that speaks for itself! And it strikes right home to every executive who is interested in keeping his production steady . . . in cutting costs in his plant!

When H. A. Lockwood, president of the Lockwood Mfg. Company of Cincinnati, bought 119 Allis-Chalmers Lo-Maintenance Motors, he knew from past experience that he was going to get good performance . . . but he never realized the amazing low-cost operating record those motors would set for him!

"We haven't spent one cent for repairs!"

"We feel," said Mr. Lockwood, whose company manufactures bakery pans and supplies, "that our motors are one of the most important parts of our production process. And you can readily see that for us motor failures are costly . . . in wasted operators' time . . . in production losses . . . in maintenance costs.

"That's why we are so enthusiastic about Allis-Chalmers motors. They've done everything you said they would do, and we haven't spent one cent for repairs on any of the 119 motors since we installed them 8½ years ago!"

That's why Mr. Lockwood ordered 33 additional Lo-Maintenance Motors to take care of expansion needs. And that's why in every industry . . . in plants throughout the country . . . plant managers are switching to Allis-Chalmers Lo-Maintenance motors! They know they get that extra margin of full measure protection that's built into every Allis-Chalmers Lo-Maintenance Motor.

Husky, all-around construction with no skimping on material . . . high carbon steel frame . . . indestructible rotor and distortionless stator . . . that's a combination that beats costly repair bills, eliminates time-wasting shut-downs!

Get the story of how Allis-Chalmers' 90 years of advancing with industry works for you when you buy a Lo-Maintenance Motor! Call the nearest District Office or write direct to Allis-Chalmers. Find out how you can cut costs . . . keep production steady with Lo-Maintenance Motors . . . the motors that give you more than just a rated horsepower! 1033

MOTORS FOR ALL APPLICATIONS FROM ½ HORSEPOWER AND UP

ELECTRICAL DIVISION

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

THERE'S A RED LIGHT ON

look out for an increase in

THE MAN in charge of plant operations is penalized many ways by accidents. Production is always delayed. Work in process or equipment may be damaged. Men may be hurt, temporarily or permanently, forcing replacement. Morale may be upset. And a large number of accidental injuries is likely to increase the firm's insurance costs — adding to the overhead his division must bear.

That's why proper selection of an insurance company is so important to plant management, for the insurance company's service can be a vital factor affecting departmental costs.

Insuring thousands of industrial firms, we have proved that safety plans can be made to work not only against injuries to men but against production delay. Management executives have seen departmental costs of production go down — because plant organization has been trained in routines and habits which avoid encounters with trouble.

They have also seen their share of insurance costs reduced through lower premiums and regular 20% policyholders dividends — and have seen valued men, given up for lost through disabling injury, returned to the jobs for which they were trained, by virtue of the medical treatment provided by American Mutual.

AMERICAN MUTUAL *Works to Make*

American Mutual offers opportunity for savings on Automobile, Fidelity Bond, and practically all other lines of casualty insurance in addition to Workmen's Compensation.

BRANCHES IN 59 OF THE COUNTRY'S PRINCIPAL CITIES

THE TRACK *production cost*

This Company's Premium Rate Below State's Average

The rate a pipe maker has paid is represented by the broken line; the average rate for similar firms in the state is shown by the solid line. With the help of our accident prevention, this policyholder has saved about 30% regularly. And they made a further saving through 20% cash dividends.

SAFETY! AN AID TO LOWER PRODUCTION COSTS

To you who have the responsibility of plant management and safety procedures, we offer a well-tested method of accident prevention which includes such features as:

A. Careful study of hazards evidenced by past accidents and of potential accident causes.
B. Application of proven safety principles to the existing production requirements — without expensive or upsetting changes.
C. Enlisting of all employees — from bottom to top — in a conscious effort to stamp out accident causes.
D. Service gauged by the plant's needs, not according to a cut-and-dried schedule.

You'll learn more about this specialized service by reading "Three P's of Safety." It's a free book. Send the coupon today.

All Work Safe

Admitted Assets: $38,330,807.44
Liabilities: $32,365,700.56
Surplus to Policyholders: $5,965,106.88
As of Dec. 31, 1938

THESE ARE THE THREE OPPORTUNITIES TO PROFIT WITH AMERICAN MUTUAL

1. Through safety services which help to lower production costs (including, frequently, insurance rates).
2. Through the restored working capacity of valued men whose injuries are treated by industrially trained doctors.
3. Through cash dividends which every year have returned to all policyholders 20% or more of insurance costs, on practically all forms of insurance except life.

American Mutual Liability Insurance Company
Dept. C6, 142 Berkeley Street, Boston, Massachusetts

Please send me, without obligation, your free booklet, "Three P's of Safety."

Name..... *Title*.....

Firm.....

Street.....

City..... *State*.....

WHEN YOU BUY GARGOYLE

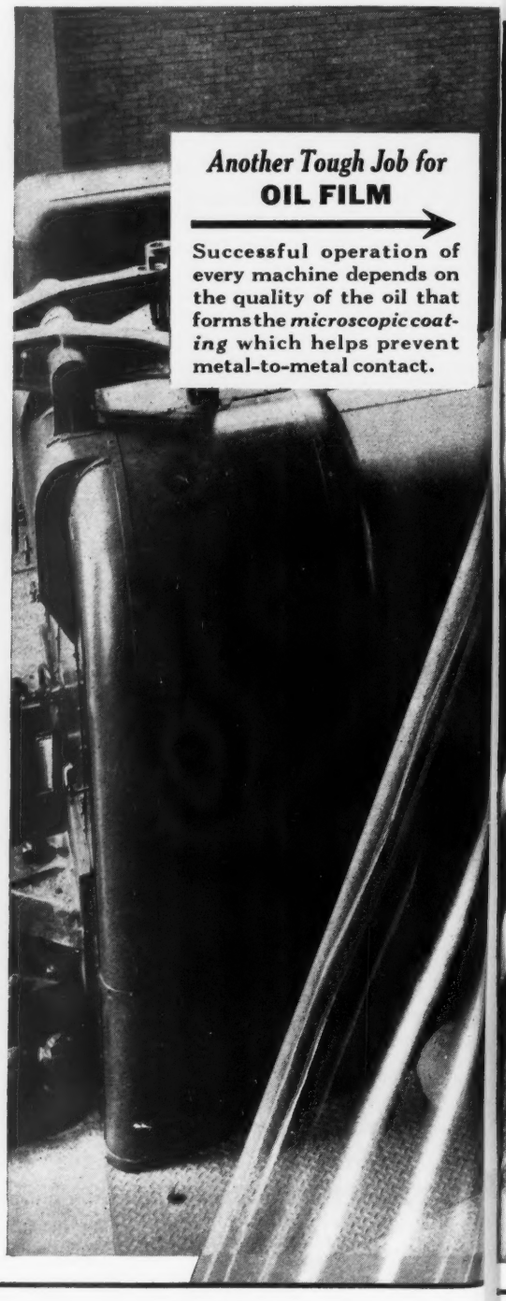
Oil Plus E

One of the most important ingredients in Gargoyle D.T.E.'s is the experience that goes into their manufacture.

Unmatched years of research and refining combine to make these oils have exceptional purity and stability.

Unmatched service hours prove they can be depended upon to protect machine investments worth millions.

For today, Gargoyle D.T.E.'s protect over half the world's major turbines.


Another Tough Job for
OIL FILM
Successful operation of every machine depends on the quality of the oil that forms the *microscopic coating* which helps prevent metal-to-metal contact.

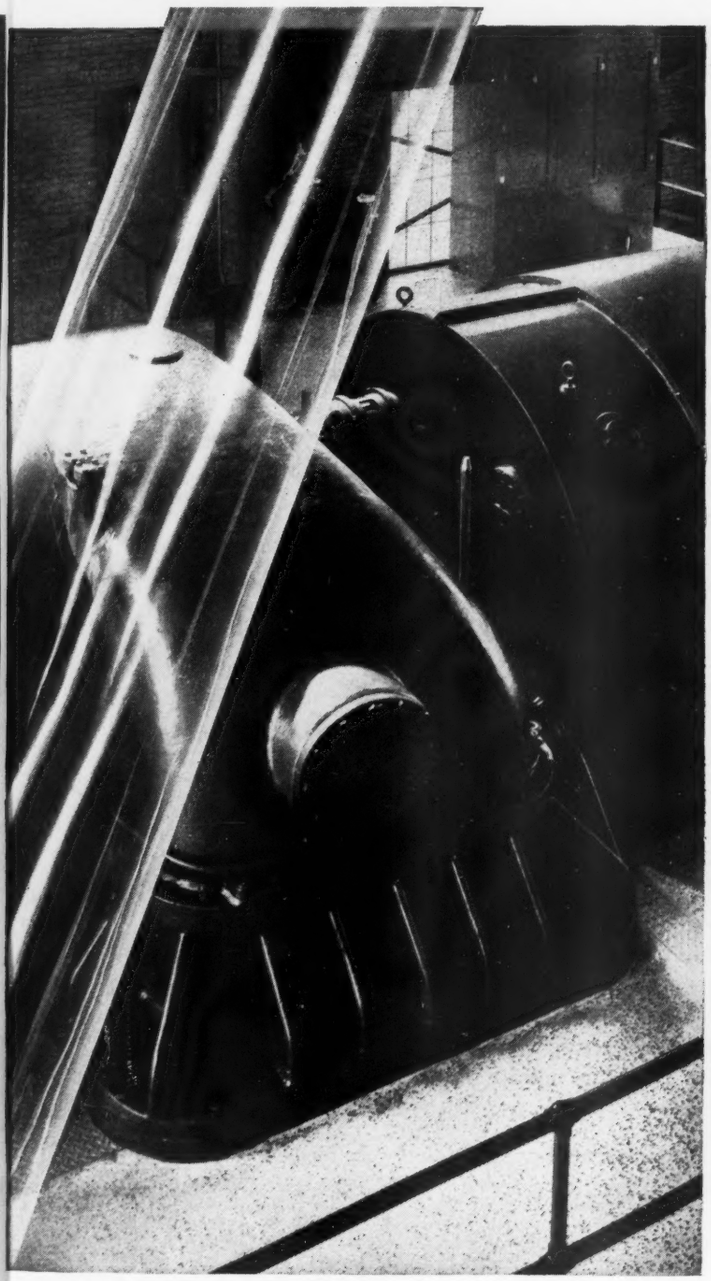
THE SOCONY-VACUUM man offers you a complete line of lubricants, plus these *exclusives:*
The right lubricant for every machine . . . and new lubricants ahead of new needs . . . developed by world-famous research laboratories through close cooperation with machine builders.

73 years' experience—thousands of case histories—to guide in prescribing the right use of these lubricants to gain Lubrication Profits for you.

World-wide distribution and guaranteed uniformity—the same quality available everywhere.

D.T.E. OIL—YOU BUY

xperience!



SOCONY-VACUUM

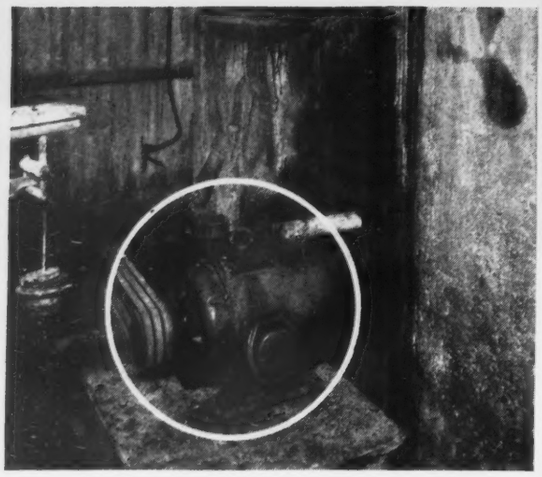
Industrial Service and Lubricants Help to Lower Costs by

Correct Lubrication

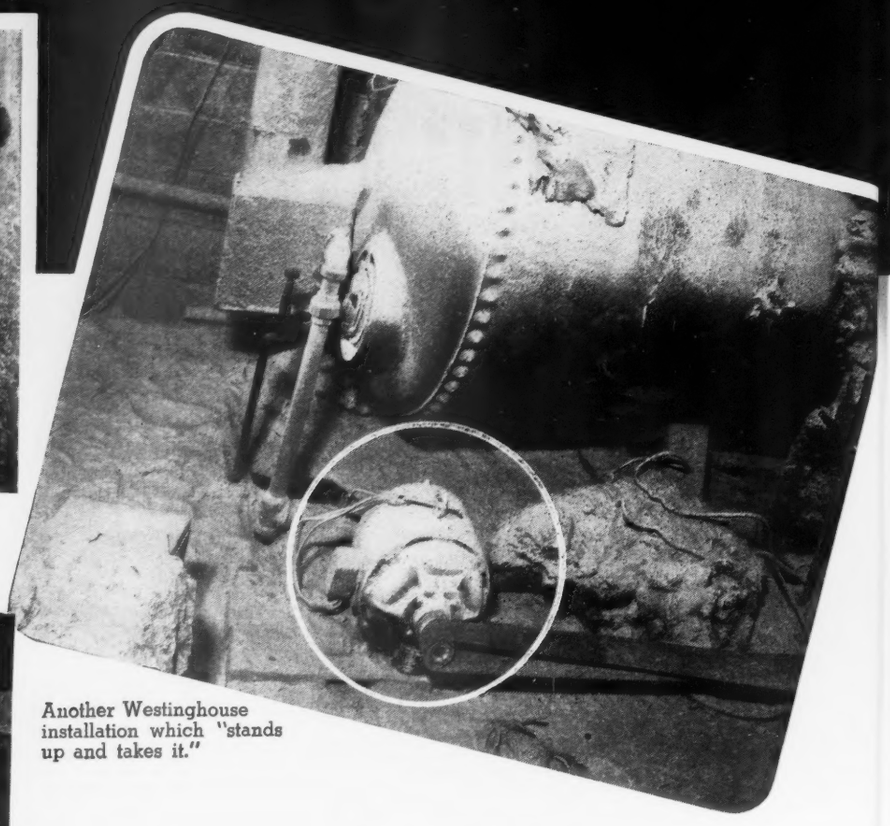
GARGOYLE Lubricants

SOCONY-VACUUM OIL CO., INC.

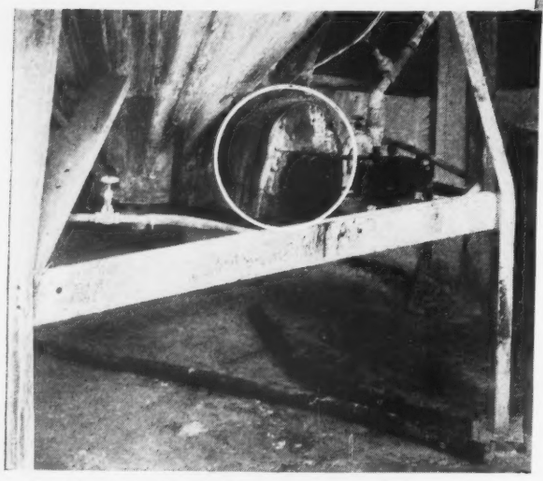
Standard Oil of New York Division · White Star Division
Lubrite Division · Chicago Division · White Eagle Division
Wadhams Division · Magnolia Petroleum Company
General Petroleum Corporation of California



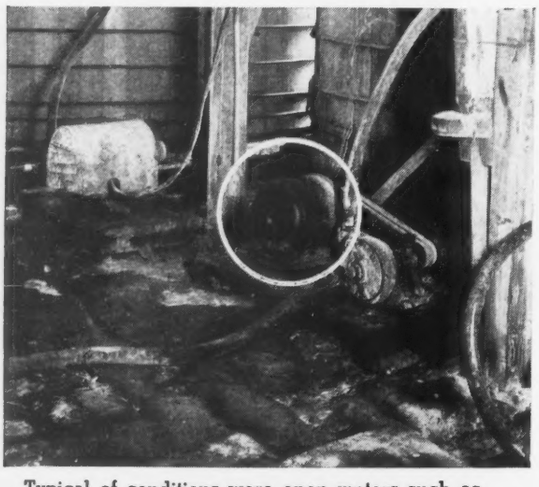
Fan-cooled, totally enclosed Westinghouse motor operates perfectly, with only preventive maintenance, even under these severe conditions.



Another Westinghouse installation which "stands up and takes it."



Conditions under which open motors fail, in the presence of gas fumes which combine with moisture in the air to form highly destructive acids.



Typical of conditions were open motors such as shown in the circle. The only protection was sheet metal covers on some motors as shown above.

$500 EXTRA PROFIT!

Investment in new motors proves profitable for chemical company — saves repair bills caused by acid attacks on ordinary motors

Insulation failures caused by splashing acids caused heavy motor repairs for Sterling Products Co., Easton, Pa. Metal hoods and other devices failed . . . in hot weather, stored heat caused overheating and burnouts.

One 3 hp open motor driving a stirrer failed in ten days due to acid attacks on windings caused by SO_2 gas in the air. A totally enclosed, fan-cooled Westinghouse motor replaced it, and shows no trouble in 5 months of operation. This and other replacements are earning estimated savings of about $500 per year.

A survey of your electric drives may indicate opportunities for similar economies. Ask our local representative. There is a Westinghouse electrical wholesaler, industrial agent, or district office in all principal cities.

J-90211

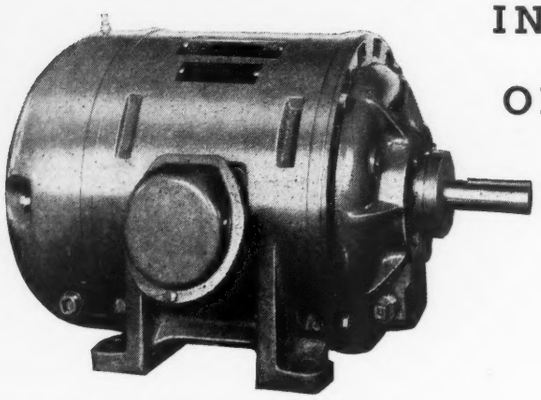
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Westinghouse

W
WESTINGHOUSE ELECTRIC

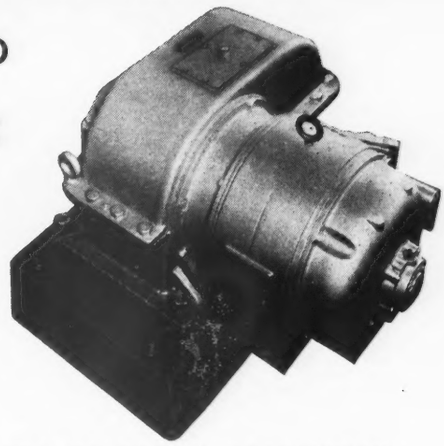
Westinghouse Money Savers

MOTORS THAT STAND UP AND TAKE IT IN ANY KIND OF SERVICE



TOTALLY ENCLOSED, FAN-COOLED MOTOR

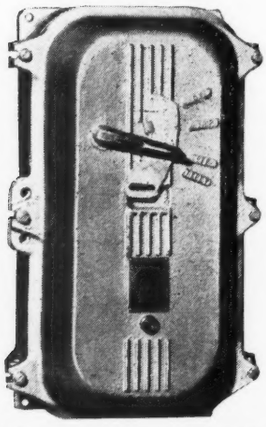
To resist destructive attacks — the electrical working parts in the Westinghouse totally enclosed, fan-cooled motor are sealed from outside air, cooled by dual ventilation. They stand up in service under dust and dirt conditions that would ruin an ordinary motor.



SPLASH-PROOF GEARMOTOR

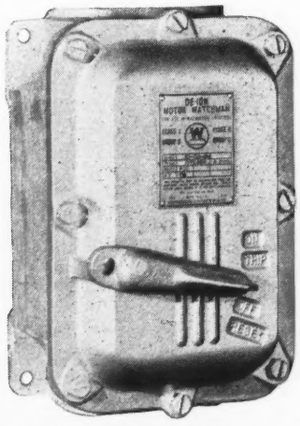
Protected from dripping and splashing liquids — Westinghouse splash-proof gearmotors are especially adaptable for use both indoors and out. Compact, slow speed drives with the efficiency of high speed motors. Deliver required horsepower at desired speed.

CONTROLS THAT DEFY TOUGH CONDITIONS



DUST-TIGHT COMBINATION LINESTARTER

Weatherproof control does 4 jobs — in this cast-iron enclosure, all four necessary devices in the motor circuit are protected from dust, dirt, moisture, and weather. One enclosure combines magnetic starter, disconnect switch, motor overload protection, and Nofuze Circuit Breaker.



MOTOR WATCHMAN FOR EXPLOSIVE ATMOSPHERES

Manual Motor Starter — the new Westinghouse "De-ion" Motor Watchman, for motors up to 7½ hp, especially designed for explosive atmospheres. Features include "De-ion" Arc Quenchers to prevent flashover, lifetime calibration in snap action bi-metal overload protection.

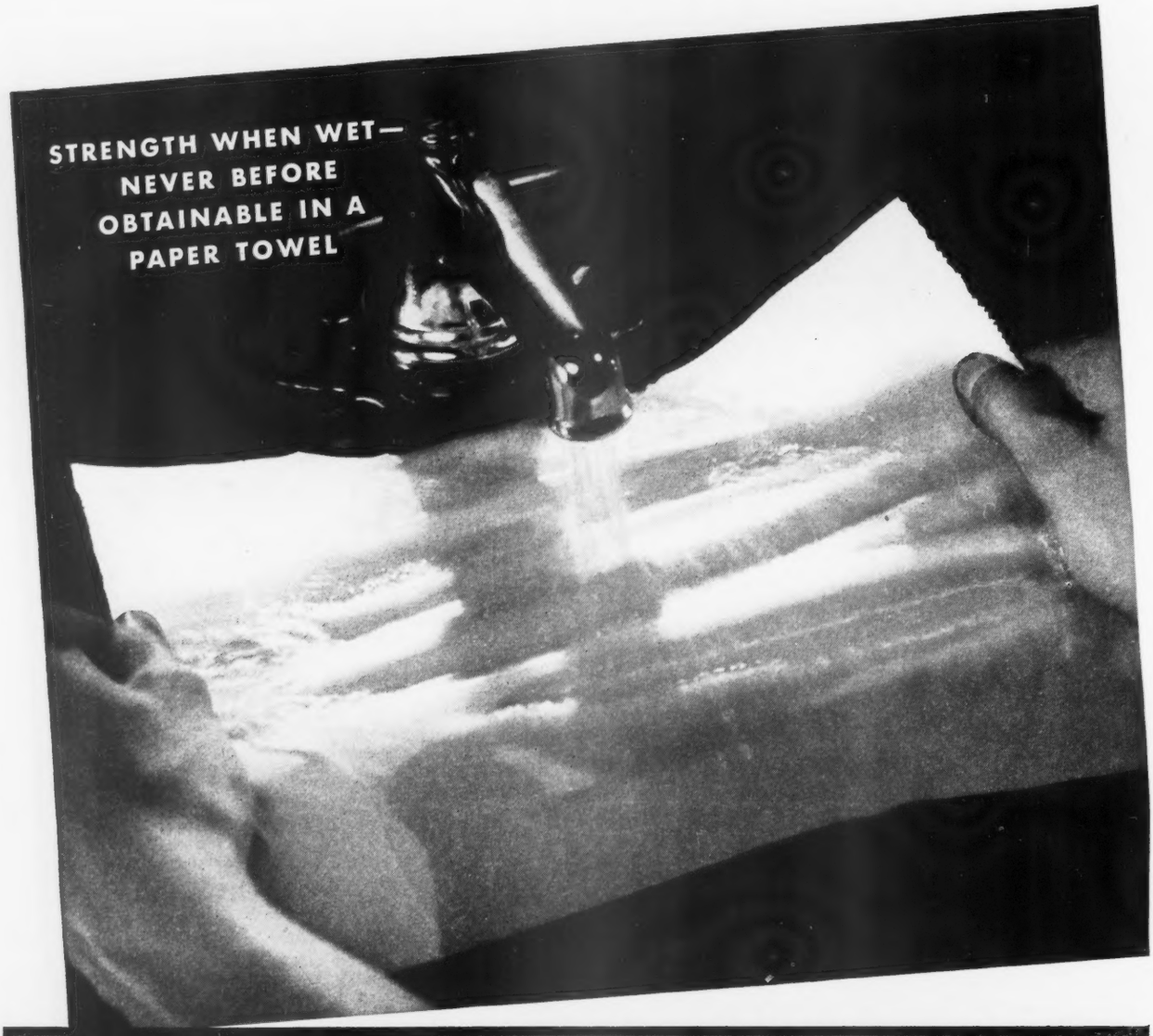
OIL-IMMERSED PANELBOARD

New corrosion-resisting panelboard — Westinghouse oil-immersed FUSELESS lighting panelboard, protected against corrosive atmospheres, with NEW bi-metal compensator that maintains correct calibration regardless of exposure to heat or cold.

Motors and Control

AQUALIZED

(An exclusive wet strength process)



THE AQUALIZED FEATURE CREATES THESE ADVANTAGES

WET STRENGTH

Won't disintegrate when wet. Eliminates towel waste.

ABSORBENCY

Quickly absorbs every bit of water. So *one* wipes dry.

NO FUZZ OR LINT

Fibres are welded in place. No "towel dandruff."

SOFTNESS

Soft and cloth-like. Never harsh. Pleasant to use.

achieves an entirely New Paper TOWEL *...stronger when wet*

An exclusive, laboratory-born process has at last eliminated the common fault of paper towels—their tendency to dissolve and fall apart when wet.

The name of this amazing accomplishment is the *Aqualized process* . . . and is to be found *only* in Aqualized Towels.

As a result, Aqualized Towels astonish everyone with their strength when wet, their unusual capacity for absorbing water from wet hands without tearing, fuzzing or breaking down.

With Aqualized Towels, a wholly new economy is possible in the washroom. For every Aqualized Towel can be—and *is*—*fully used*. Towel waste is eliminated, better towel service assured and lower washroom costs achieved.

See Aqualized Towels for yourself . . . and see the greatest advance ever made in paper towels! The name is *Aqualized*. Manufactured solely by Brown Company, 420 Lexington Avenue, New York, N. Y.

WHY "AQUALIZED" IS A BUY-WORD

1. All paper towels are made from wood cellulose. Brown Company, manufacturer of Aqualized Towels, is also the foremost producer of purified wood celluloses.

2. Brown Company has *complete control* over its raw material, so that at no time can outside circumstances interfere with the maintenance of rigid quality standards.

3. Highly specialized celluloses—exclusive developments of Brown Company—are used to produce finest toweling.

4. The basic cellulose materials used in these towels are White Husky Cellate and Sulphate pulps, both made from selected Northern Spruce.

5. This basic, quality material is then given the Aqualized process—sole property of Brown Company—to *weld* the fibres into a strong, soft, cloth-like towel.

SPECIFY NIBROC AQUALIZED TOWELS *The Aqualized feature is now available in the well known NIBROC brand of paper towels. Sold by leading paper merchants throughout the United States and Canada.*

NIBROC*
AQUALIZED*
AN EXCLUSIVE WET STRENGTH PROCESS
TOWELS
* REG TRADE MARK
A CELLULOSE PRODUCT OF
BROWN COMPANY
QUALITY

AQUALIZED TOWELS

REG. U. S. PAT. OFF.

GENERAL ELECTRIC MAKES LAMPS FOR

PERHAPS I DO NEED MORE LIGHT BUT IT'S TOO EXPENSIVE!
That's what you think! ...G-E LAMPS COST LESS AND BETTER LIGHTING ACTUALLY SAVES YOU MONEY

Here's why:

1. G-E LAMPS GIVE MORE LIGHT FOR LESS MONEY because scientific research and development year after year are producing lamps which operate at constantly greater efficiencies, yet sell at continually lower prices.

2. G-E MAKES A COMPLETE LINE OF LAMPS . . . representing *every* type of electric lamp practical to industry. This fact assures you of an unbiased recommendation for lighting to fit every need.

3. SIXTY YEARS OF MANUFACTURING and application experience is back of every lamp General Electric makes. Many of these lamps must pass as many as 480 checks, tests, and inspections to assure satisfactory performance.

4. G-E's SYSTEM OF STRATEGICALLY located warehouses, supplemented by wholesalers' stocks, practically assures 24-hour delivery anywhere in the United States. This saves you time and storage space.

5. G-E's LIGHTING ENGINEERING SERVICE at Nela Park and in 17 key cities offers you its wealth of knowledge in solving lighting problems and in helping you get the most for your lighting dollar. It's yours for the asking.

• • •

For specific information, write the General Electric Lamp Division nearest you, or Nela Park, Cleveland, Ohio.

Get these benefits by light-conditioning your plant with G-E lamps!

Let a G-E Lighting Specialist show you how light-conditioning can improve working conditions and actually help increase profits by:

1. Increasing efficiency of operation.
2. Providing means for more accurate work.
3. Effecting more efficient maintenance of equipment.
4. Conserving eyesight.
5. Reducing accidents.
6. Improving morale because of brighter more cheerful working conditions.

• • •

For further information, write General Electric Company, Lamp Department, 166-F-L, Nela Park, Cleveland, Ohio.

GENERAL ELECTRIC

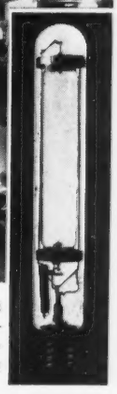
LAMP DEPARTMENT, NELA PARK, CLEVELAND, OHIO

EVERY INDUSTRIAL LIGHTING NEED!

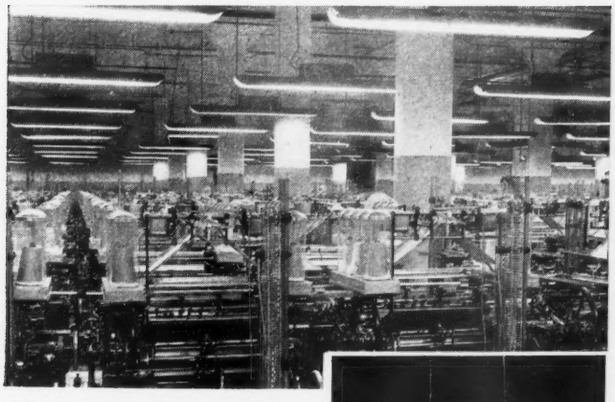
G-E MAZDA filament lamps fulfill most industrial requirements for general lighting service. They are made in sizes from 15 up to 1500 watts, and available in certain sizes in clear, inside frosted, white bowl, silvered bowl, and daylight bulbs.

G-E MAZDA Projector lamps concentrate light where it's needed. Lens, reflector, and filament are one sealed unit.

G-E MAZDA F (fluorescent) lamps make possible higher lighting levels and are 50% cooler than filament lamps. Available in daylight, white, and five colors, in several lengths and wattages.



G-E MAZDA H (mercury) lamps—400 watt size shown—have high efficiency, long life and ruggedness—very practical for high bay areas. May be used advantageously either alone or in combination with filament lamps.



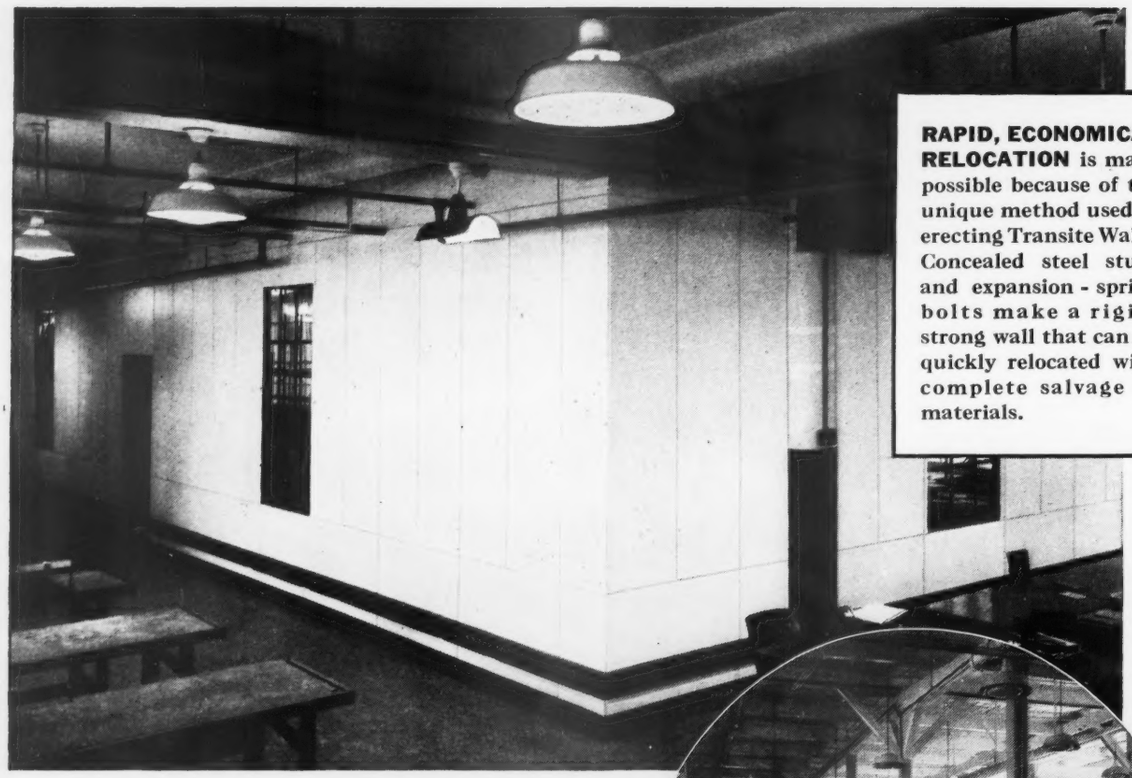
RF 85 WATT (Cooper Hewitt fluorescent) lamps (100 watts overall) for high levels of industrial illumination. Make night work as pleasant as day work. Have long life . . . low operating cost.

COOPER HEWITT mercury vapor lamps are long tube light sources free from shadow, and easy on eyes because they contain only cool yellow-green rays. Excellent for showing up small objects and detail.

GENERAL ELECTRIC

LAMP DEPARTMENT, NELA PARK, CLEVELAND, OHIO

SAVE MONEY ON CHANGES WITH THESE PERMANENT PARTITIONS



RAPID, ECONOMICAL RELOCATION is made possible because of the unique method used in erecting Transite Walls. Concealed steel studs and expansion - spring bolts make a rigid, strong wall that can be quickly relocated with complete salvage of materials.

J-M Transite Walls provide all the solidity and privacy of fixed partitions . . . yet can be relocated with 100% salvage of material

SOONER OR LATER, offices in your plant will be moved around. Get set for these changes now by building with J-M Transite Walls. A unique construction method makes initial erection and relocation equally simple, rapid and economical.

Made of asbestos and cement, Transite Walls will not burn, rot or decay. Their tough, durable structure keeps repair bills low. And because this modern material is highly resistant to sound-transmission, offices are quieter and more efficient.

The new Transite Walls brochure gives all the facts. For your copy, simply write Johns-Manville, 22 East 40th Street, New York, N. Y.

ANY TYPE OF OFFICE can be built with Transite Walls. Made of asbestos and cement, this modern material is tough and durable . . . resists cracking and denting. Maintenance stays low, because Transite Walls seldom, if ever, require repairs or replacement.

JM PRODUCT

Johns-Manville TRANSITE WALLS

When Profit is Your Purpose

. . . THERE'S A DISSTON BITE-RITE FILE TO DO EVERY JOB BETTER, FASTER

You know that knocking fins off castings, and smooth finishing of brass on lathe work require different kinds of files. But what you may not know today, is the tremendous variety of files made by Disston. Truly, there is "the correct file for every filing job," when your final purpose is profit.

In practically every standard shape for machine shop service, Disston Files are made in three different cuts: *Smooth Cut*, the finest; *Second Cut*, the next finest; and *Bastard*, coarse cut. Mill Files are also made in these cuts and in addition, a "MILL FINE BASTARD CUT."

You get the right file to do your job better, faster. And Disston Bite-Rite Files give you these added advantages:

Teeth staggered like a harrow; cut, smooth, level at each stroke. Correct contour of cutting tip, rugged shoulders between the teeth.

And the Bite-Rite round, smooth, open gullet assures free, clear, clean discharge of chips . . . heavy, long, curling, like chips from a lathe tool.

Disston Engineering developed this file which combines speed of cut, long life and smoothness of filed surface.

Ask your Distributor of Disston Bite-Rite Files to help you choose the right shape and cut to speed up production, give better work. Henry Disston & Sons, Inc., Philadelphia.

BITE-RITE

New Disston File

PRODUCTION DOUBLED *by a simple change to Fafnirs . . . . . .*

THAT PAID FOR ITSELF IN 30 DAYS!

BEFORE . . .
On this high-speed, double-wheel grinding head at the Erie Tool Works, Erie, Pa., plain bearings accounted for:

EXCESSIVE MAINTENANCE COSTS. The bearings had to be rebabbitted every month. Worn parts and oil-soaked belts required replacement with unnecessary frequency.

EXTENSIVE LUBRICATION COSTS. Oiling was necessary *every thirty minutes.*

INEFFICIENT PRODUCTION. Although a double-head machine, only *one* man could work at a time, due to wheel-wobble . . . And Shaft Speed was limited to 1400 r.p.m. because of belt slippage, vibration and shaft-drag.

AFTER . . .
A simple conversion to FAFNIR Double Pillow Blocks, incorporating FAFNIR Wide Inner Ring Bearings, resulted in:

SLASHED MAINTENANCE COSTS. These bearings are virtually non-wearing. And the elimination of heavy starting-torques resulted in increased life of belts and associated parts.

LUBRICATION SAVINGS. *Greased* once every *three months*, instead of oiling every *thirty minutes.*

DOUBLE PRODUCTION. Two men instead of one, because all wheel-wobble was eliminated. Shaft speed increased from 1400 to 1850 r.p.m. Belt slippage practically vanished.

Because of the simplicity with which Fafnirs are installed, the entre cost of the changeover, including the Pillow Blocks, was just $50. The saving in the *first* month (exclusive of increased production) was $51 . . .

Such savings are common knowledge wherever Fafnirs have been applied. Fafnir Ball Bearings are available from Industrial Distributors everywhere. Or send for descriptive literature. The Fafnir Bearing Co., New Britain, Conn.

FAFNIR *Ball Bearings*

THE BALANCED LINE • MOST COMPLETE IN AMERICA

MASTER
More geared head
motors in use today
carry the Master name
than all other makes
. . . COMBINED.
THE MASTER ELECTRIC COMPANY • DAYTON, OHIO

IT'S THE DRIVE YOU USE THAT MAKES THE DIFFERENCE

Two Yards At A Bite Without Indigestion

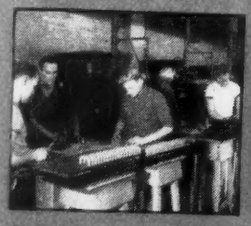
● Back of the steel dipper teeth of giant power shovels is tremendous power—engine power that is transmitted unfailingly and efficiently by—*roller chain drives.*

Power shovels perform no namby-pamby job under carefully protected and coddled conditions. . . . They are put to work on big construction projects, on dam sites, levees, mountain roads—in the tropics or arctics—often far away from handy service.

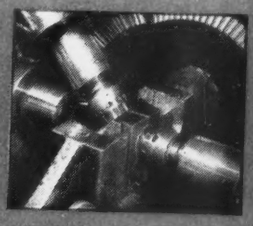
Diamond Roller Chains for years have proved their worth and stamina in such brawny work, they are regularly used by leading manufacturers of excavating and construction machinery, yet are equally adaptable for the average drive, low, medium or high speeds, and for the finest and most precise applications. . . . Catalog and engineering data book on request. DIAMOND CHAIN & MFG. CO., 449 Kentucky Avenue, Indianapolis, Ind. *Offices and Distributors in All Principal Cities.*

IT'S THE DRIVE YOU USE THAT MAKES THE DIFFERENCE

From Metal To Final Inspection They Must Be Right!

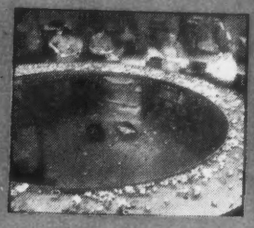


SMOOTH cores for free flow . . . skilled core-makers using finest materials assure smooth inside finish in Grinnell Fittings.



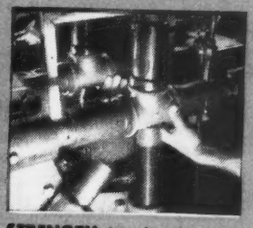
ACCURATE jaws hold the fitting as sharp taps cut the clean threads that mean easy running up and tight joints.

UNIFORM wall thickness and smooth finish are assured by high-grade pattern equipment and careful setting of cores.

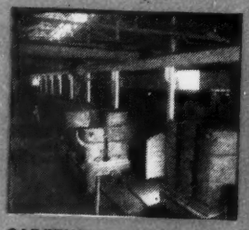


RIGID INSPECTIONS check the fittings at three points in their manufacture to maintain the Grinnell Standard.

SUPERIOR metal is poured carefully to make these fittings —under direct supervision of the man responsible for each molding floor.

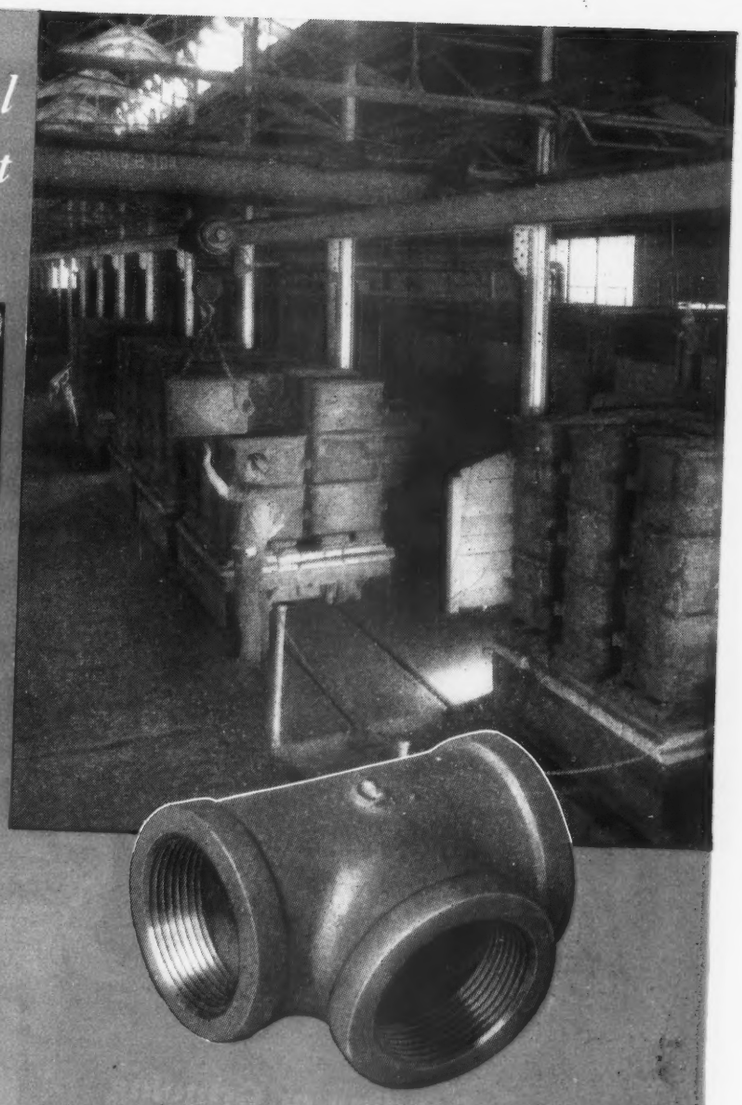


STRENGTH is checked by sample tests in hydraulic machines which force oil under tremendous pressure into the fittings.



CAREFULLY CONTROLLED annealing eliminates strains in the fittings castings . . . gives them rugged strength to take shocks in service.

DIMENSIONAL ACCURACY is checked on test fittings by methods like that shown . . . testing a 2" tee with steel square.



RUGGED STRENGTH...

Up To Grinnell Standard!

To meet the Grinnell Standard, fittings must be easy to use; make a tight joint; be smooth, inside and outside; and have the rugged strength that withstands shocks in service. Carefully controlled annealing that eliminates strains in the fittings castings gives them that rugged strength to withstand strain . . . strength that makes these fittings the strongest link in your piping system. Choose from the wide Grinnell line. Continent-wide service through branch offices, wholesalers and heating and plumbing contractors. Write for catalog, "Grinnell Pipe Fittings." Grinnell Company, Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.

CAST IRON . . . AIR FURNACE MALLEABLE IRON . . . STEEL . . . BRONZE FITTINGS BY

GRINNELL

WHENEVER PIPING IS INVOLVED

Whatever your work is in sanding, grinding or metal cleaning . . . there is a SKILSAW SANDER to fit your requirements, to save you time and money over hand methods, to do a better job easier!

Industry uses SKILSAW Disc and Belt Sanders for grinding raised welds, sanding spot-welds, producing a satin-smooth finish on all metals, removing scale and rust, finishing surfaces of wood, metal, marble, tile and compositions—in production and maintenance work.

Ask for a demonstration of one of these SKILSAW SANDERS on your own work and you'll see how quickly it pays for itself.

SKILSAW, INC., 5043 Elston Ave., Chicago

36 East 22nd St., New York—182 Main St., Buffalo—52 Brookline Ave., Boston 15 S. 21st St., Philadelphia—2124 Main St., Dallas—918 Union St., New Orleans—1253 South Flower St., Los Angeles—2065 Webster St., Oakland—29 North Ave., N.W., Atlanta. Canadian Branch: 85 Deloraine Ave., Toronto.

SKILSAW
PORTABLE ELECTRIC TOOLS
SAVE MONEY IN EVERY INDUSTRY!
· SAWS · DRILLS · BELT SANDERS · DISC SANDERS · GRINDERS · BLOWERS ·

● Sold by leading distributors of mine, mill, hardware and contractors' supplies.

Wherever Sanding or Grinding is done . . . one of these

SKILSAW SANDERS

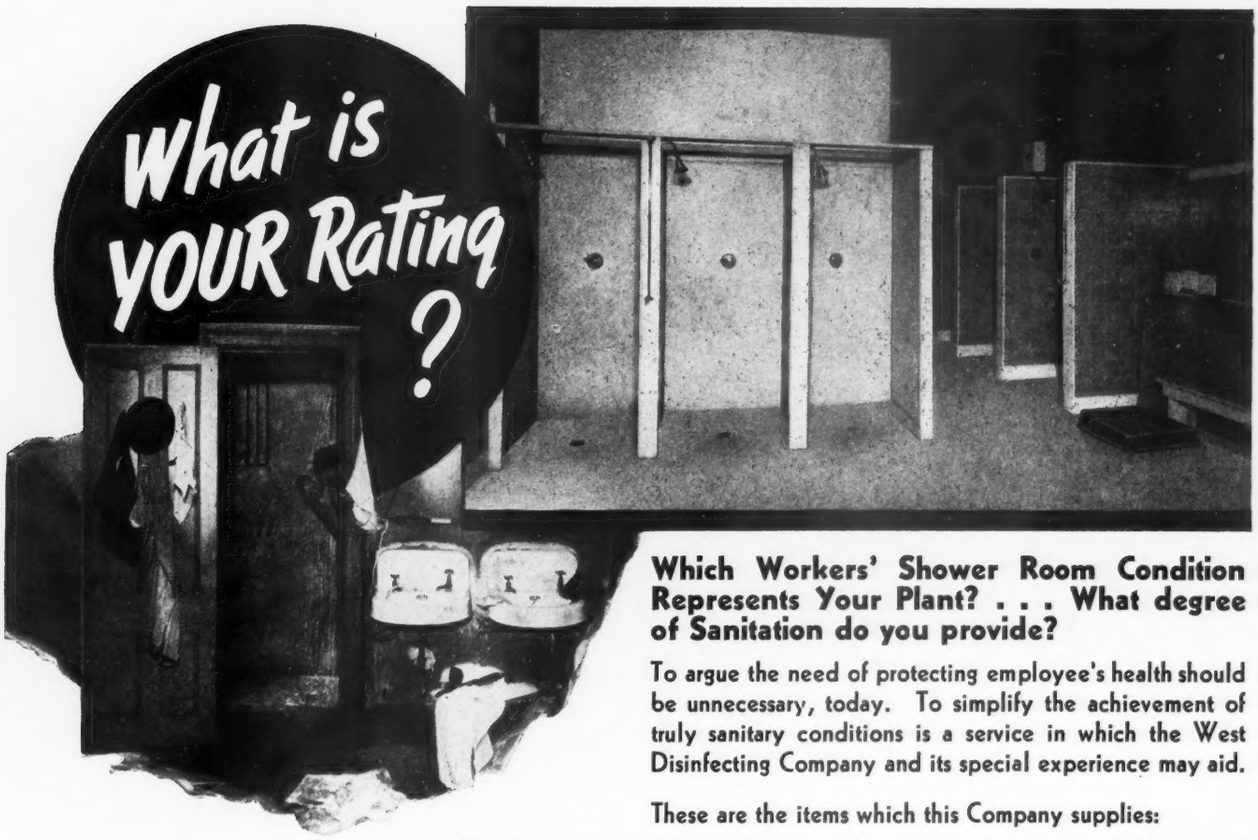
will do it better, quicker and cheaper!

SKILSAW DISC SANDERS

Engineered for quiet speed and smooth power, designed for comfort in handling. Made in 3 models for use with wire brushes, cup grinding wheels (up to 6 in. dia.), polishing pads—on flat, concave and convex surfaces of metal, wood, stone, marble, tile and compositions.

SKILSAW BELT SANDERS

Made with and without vacuum dust collector in a variety of belt speeds for sanding and finishing on flat surfaces of all metal, wood and compositions. Easy to handle, perfectly balanced, plugs into any light socket. Made in 3 models.



Which Workers' Shower Room Condition Represents Your Plant? . . . What degree of Sanitation do you provide?

To argue the need of protecting employee's health should be unnecessary, today. To simplify the achievement of truly sanitary conditions is a service in which the West Disinfecting Company and its special experience may aid.

These are the items which this Company supplies:

1 Liquid Soap and Liquid Soap Dispensers for your wash basins and shower stalls — products developed through 30 years of specialization, and created to your needs. Liquid soaps of various types, to fulfill your own special requirements.

Economical products — as they must be to command preference in today's competitive world. Worth investigating!

To appreciate the extent of West service and the economy of West products, you should go farther than reading this advertisement. For your general information we would be glad to send you the 64 page booklet coupon—noted below. Write for a copy.

2 Westochlor, to help prevent the spread of Athlete's Foot — a disinfectant liquid to be diluted for use in a West Rubber Foot Tray as illustrated above.

Westochlor is a disinfectant which has been proven effective both for foot-bath use and for general daily disinfection of the floor surfaces in shower rooms, swimming pool areas, and the like.

3 West Paper Towels of a number of different sizes, textures and absorbent-quality specifications.

4 Disinfectants, deodorants and sanitary supplies for toilet and wash rooms throughout the plant and office buildings.

WEST DISINFECTING COMPANY

PRINCIPAL PLANT AND OFFICES
42-16 West St., Long Island City, N.Y.

A coast-to-coast service organization with Branches and Offices in: Albany, Albuquerque, Baltimore, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Columbus, Dallas, Des Moines, Denver, Detroit, Evansville, Ft. Worth, Hartford, Houston, Indianapolis, Jacksonville, Jersey City, Kansas City, Los Angeles, Louisville, Memphis, Milwaukee, Newark, New Orleans, Norfolk, Oakland, Oklahoma City, Omaha, Philadelphia, Pittsburgh, Portland, Providence, Richmond, Rochester, Sacramento, St Louis, St. Paul, San Antonio, San Francisco, Seattle, Spokane, Syracuse, Tacoma, Toledo, Tulsa, Washington, D.C., and in Canada

WEST GUARANTEED PRODUCT

WEST DISINFECTING COMPANY
Dept. J, 42-16 West Street, Long Island City, N.Y.

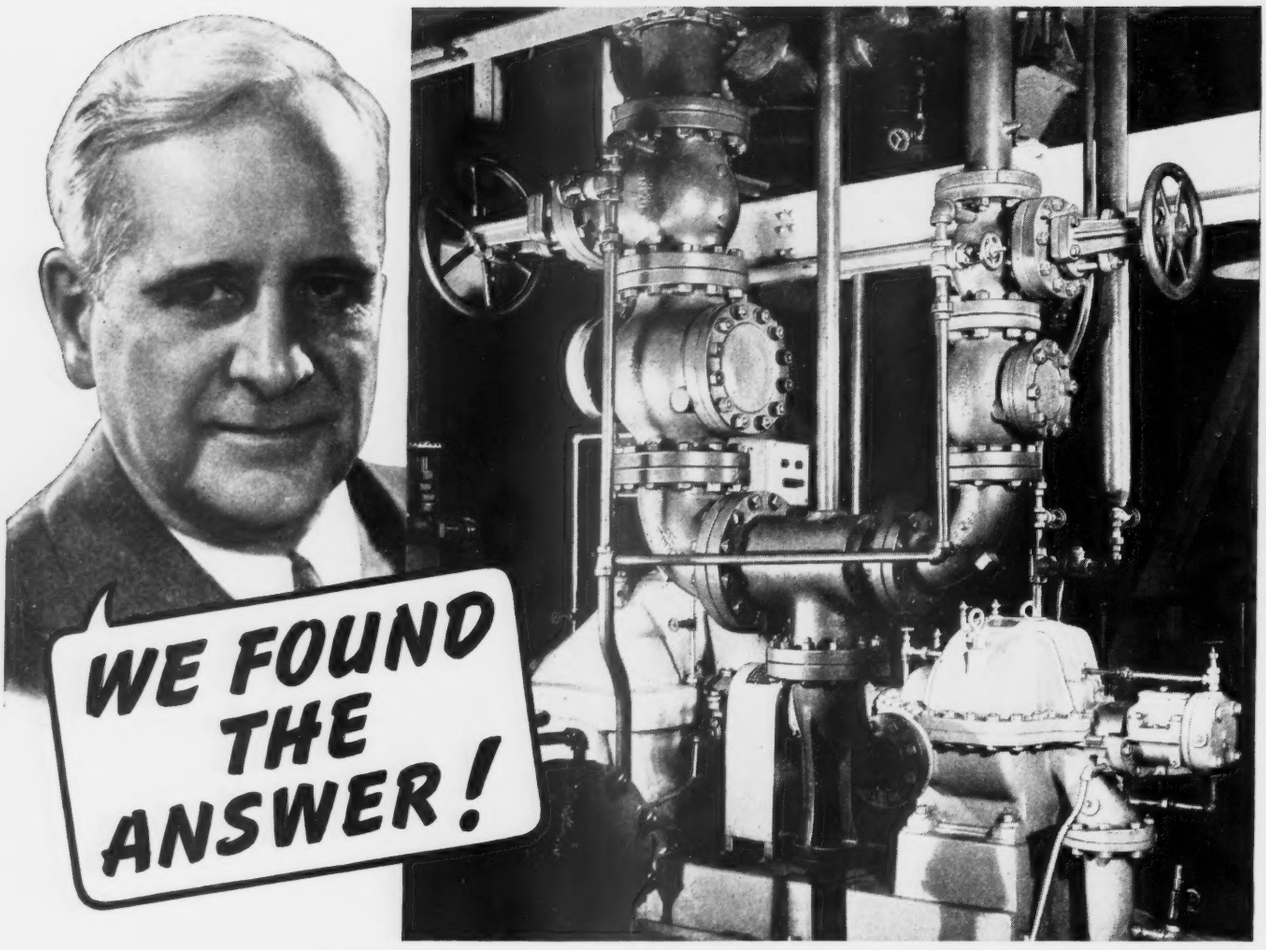
☐ Please send me a copy of your "Scope of Sanitation", which you offer without obligation.

☐ Please have your representative call.

Name _____ Title _____

Company _____

Street & No. _____ City & State _____



"PREVENTIVE MAINTENANCE keeps our piping costs down"

ACTUALLY, it's nothing new—many hundreds of plants are doing it every day. It's just a matter of using good foresight when you're buying valves and fittings.

Preventive Maintenance is simply this: It means fortifying your piping with extra resistance to the stress and strain of service conditions. There lies your greatest assurance of dependable flow control at minimum cost. And it means making sure that your piping equipment is right for the job to be done—right for the safety required.

Whether your plant is small or large—with Crane valves and fittings you can carry on a successful program of Preventive Maintenance. That's because in Crane-Quality you get the finest development of design and materials in flow-control equipment. And in the Crane line of over 38,000 items is exactly the one you need for efficient and economical piping in every application in your system.

Just as he has helped others, your Crane Representative will gladly work with you. Through him, Crane's vast experience in solving industry's piping problems is applied to your individual case. Back of him, at your service, are Crane's extensive resources of technical knowledge, Crane's elaborate research and plant facilities.

If you *now* have a piping problem that's giving you headaches, then get started *now* on a Preventive Maintenance program. You'll save many dollars—you'll have peace of mind. Call your Crane Representative today. He is ready to serve you.

CRANE

CRANE CO., GENERAL OFFICES
836 S. MICHIGAN AVE., CHICAGO

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

AT P
pla
ard B
engine
cation
Power
12 hour
Westin
every d
fectly o

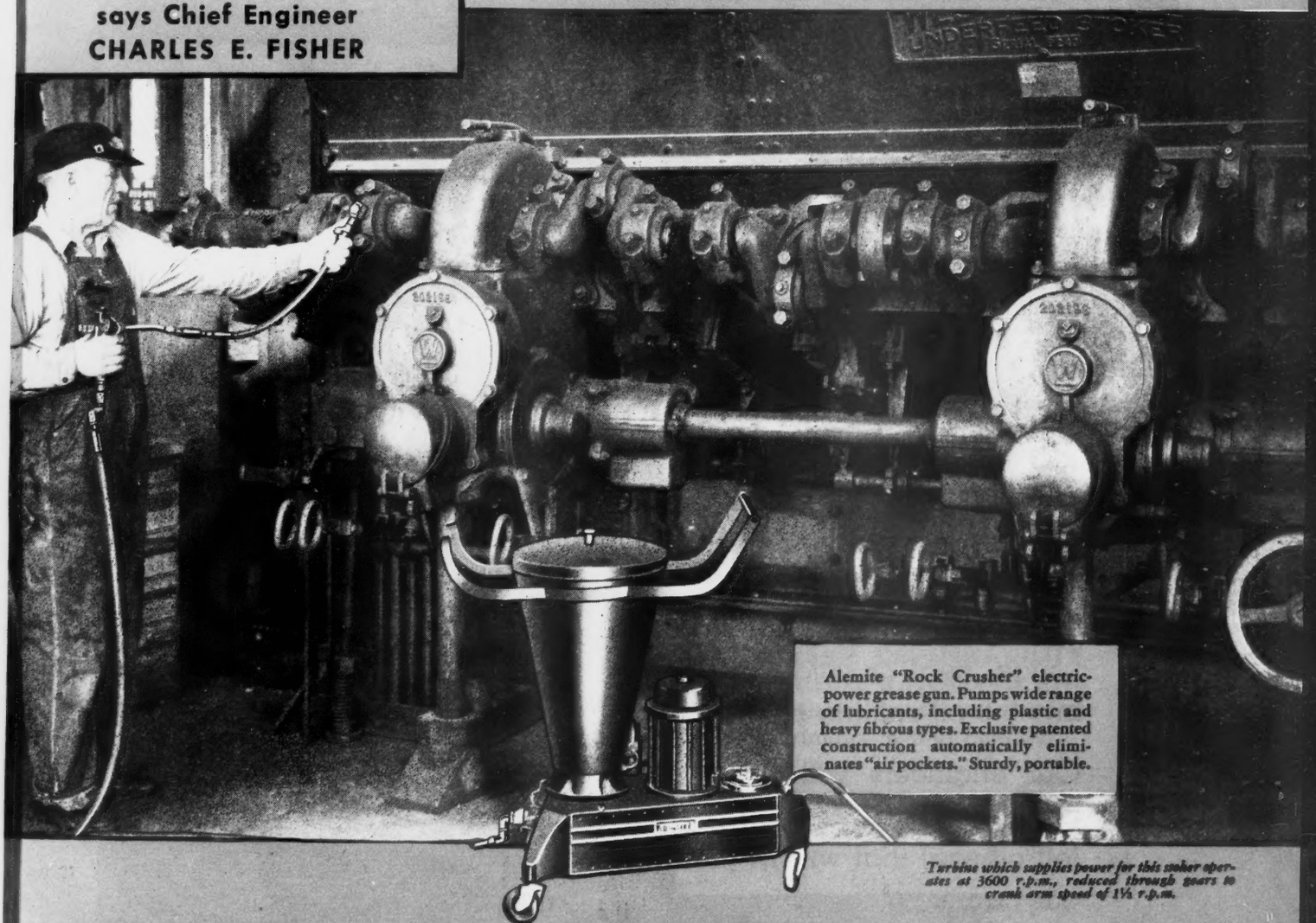
W O R

WORLD'S LARGEST YEAST PLANT

Uses Alemite Twice a Week—

INSTEAD OF OILING EVERY DAY!

"Saves us 12 hrs. a week on one machine alone"
says Chief Engineer
CHARLES E. FISHER



Alemite "Rock Crusher" electric-power grease gun. Pumps wide range of lubricants, including plastic and heavy fibrous types. Exclusive patented construction automatically eliminates "air pockets." Sturdy, portable.

Turbine which supplies power for this stoker operates at 3600 r.p.m., reduced through gears to crank arm speed of 1½ r.p.m.

AT Peekskill, New York, *the largest yeast plant in the world is operated by Standard Brands, Inc.* Charles E. Fisher, chief engineer of this plant, says that power lubrication with the Alemite "Rock Crusher" Power Gun shown in the photograph *saves 12 hours a week* in the lubrication of this big Westinghouse stoker alone! Formerly oiled every day, this machine now operates perfectly on Alemite lubrication twice a week!

Every industrial plant, large or small, has its individual lubrication problems. For most of those problems Alemite *offers special guns and special lubricants to do the job more dependably* at a saving of time and money. Consider your own lubrication practices—then consult with Alemite on savings which may be possible in your plant.

It costs you nothing to get our recommendation. Write to us today!

• • •

ALEMITE—*A Division of Stewart-Warner Corporation, 1870 Diversey Parkway, Chicago, Illinois. Stewart-Warner-Alemite Corporation of Canada, Ltd., Belleville, Ontario.*

ALEMITE

REG. U. S. PAT. OFF.

WORLD'S LARGEST MANUFACTURER OF LUBRICATION PRODUCTS

Dufelt*

A Low Cost, Serviceable OIL SEAL

DUFELT, a combination of Certified Felt and Neoprene, has proven itself in actual use to be an effective oil seal for machinery. Made of materials that will withstand hard usage, heat or cold and deterioration, Dufelt fits admirably into the oil sealing picture.

Our engineers will be glad to diagnose your oil sealing problem and to suggest the proper Dufelt or perhaps a plain felt oil seal that will fit your particular situation best. Write our nearest office today.

** U. S. Patent No. 2003934*

THE FELTERS COMPANY, INCORPORATED • 210 South Street, Dept. AB, Boston, Mass.

OFFICES: New York, Philadelphia, Chicago, Detroit, St. Louis *SALES REPRESENTATIVES: Dallas, Los Angeles, Louisville*

MILLS: Johnson City, New York • Millbury, Massachusetts • Jackson, Michigan

Only PHILCO gives you TRIPLE-INSULATED BATTERIES with K-PROCESSED PLATES

for lower haulage costs!

The revolutionary new Philco Triple-Insulated Batteries with K-Processed Plates bring you lower haulage costs per ton... *more profit for you!* Over a quarter-century of research and practical experience stands behind them. Satisfied users in all types of hauling testify to their efficiency and economy. Reasonable initial cost and low monthly cost make Philco Batteries a *real* investment. Write for full particulars.

PHILCO, Battery Division
Dept. 303, Philadelphia, Pa.

- **TRIPLE INSULATION** insures retention of the active material in the plates of the batteries.
- **K-PROCESS** produces a plate, flint-hard throughout, yet porous for easy absorption of acid.
- **HIGH POWER ABILITY** and Sustained Voltage step up production and cut current costs.
- **SUPER-EFFICIENCY** handles the difficult jobs at high speed.
- **TREMENDOUS RESERVE POWER** takes care of the heaviest loads.
- **EXTREME DEPENDABILITY** and Great Ruggedness give trouble-free day in and day out performance in your hauling.
- **LONG LIFE** assures extra years of operation and low-cost service.

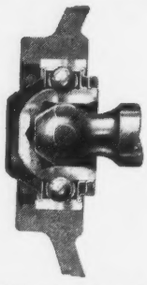
WHY ANTI-FRICTION BEARINGS?

ONE OF THE FUNDAMENTAL REASONS FOR USING ANTI-FRICTION BEARINGS

● Better production at lower cost for the machinery builders. Decreased operating expense, less maintenance and greater accuracy for the owner and user. These are some of the results of modern, simplified design.

In achieving these results, ball bearings are a tremendous aid. They make for greater compactness and rigidity. They eliminate the need for adjusting devices and other miscellaneous parts. And the machining incident to their application is less involved, makes extreme accuracy easier to attain. In many ways ball bearings—New Departure ball bearings—enable machinery builders to improve and simplify design.

For interesting brochure, GT-12, "Fewer Parts—Better Design," write to New Departure, Division of General Motors, Bristol, Connecticut.

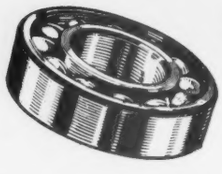


80% FEWER PARTS!

●By the use of New Departure Conveyor Roll Bearing, 80% fewer conveyor parts are used. Bearing maintenance is cut to zero! For the builder or user of conveyor and idler rolls, this is the most economical bearing available. Throughout the complete New Departure line are many other remarkable "new departures."

NEW DEPARTURE

THE FORGED STEEL BEARING



2830

INDUSTRY'S OUTLOOK AS THE WAR GOES ON

Editor's Note: FACTORY *continues its "War Communiqués" with this factual and interpretative summary of war developments affecting industry. This report (completed on December 1) is based on interviews with leading economists, industrialists, editors, and government personnel*

DOMESTIC BUSINESS IS PARAMOUNT

Domestic business will still be paramount in the coming year. There exists a genuine recovery trend, little nourished by "war business," the continuance of which is our first concern. Save for aircraft and machine tools, there has been no torrential rush of buying by the Allies. And unless Europe explodes on the Western Front, there won't be. Even so, the outlook for 1940 is favorable.

AT THE YEAR'S END

Historians will have to say for 1939 America that it met a baffling economic crisis with an impressive national display of common sense. Industry resisted the intoxicating temptations of a "war boom" while its governmental keepers stood anxiously by with restoratives for which there was no need.

Going into December, the law of supply and demand still ruled our commodities market. Stock averages hovered several points below the year's highs despite a potent fourth-quarter upturn in industrial production and corporate profits. Wages and living costs were modestly inching upward together. There was little speculation, no wild talk of sudden plant expansions.

CLOSE TO THE CHEST

Industry, after an accurate and long-headed appraisal of the war factor, has elected to play its cards close to the chest, making no bets on the cards it can't see. A visible business improvement, having a sound domestic basis so long as retail sales and payrolls continue to gain, is still the biggest economic news of the day.

As for "war business," the truth is that *Europe is still preparing for a war that has not yet begun.* Here are the lessons of history that enforce a cautious approach to the question:

In 1914, the Allies, ill-armed, ill-organized, were forced by the immensity and suddenness of the war to buy wildly wherever they could. The first $2,000,000,000 of

Allied buying here touched off a dangerous boom. Today the Allies, with two years of intense preparation already behind them, have built a munitions industry, and have laid away stocks of war matériel that will continue to grow with every day of inactivity on the Western Front. They are in no hurry to buy anything except aircraft and machine tools. About $1,000,000,000 is now the commonly accepted estimate of the first year's Allied war purchases here, a good half of which will go for planes.

U. S. industry, meanwhile, is in no great hurry to sell—if selling means expanding its plants at its own expense. It recalls too clearly the post-war headaches caused by this practice. And it knows, because it has seen borrowed billions spent so freely, that $1,000,000,000 will produce no boom.

NOT EVEN A BILLION?

From this hypothetical billion, at least $150,000,000 must be subtracted for loss of normal exports to belligerents and curtailment of U. S. shipping due to the new neutrality restrictions.

One of the men in America who should know best is skeptical even of the billion itself. The deliberateness with which the Allies are organizing their purchases, he says, is proof of the strength of their material reserves—and a tip-off on the improbability of immediate large-scale operations on the West Front. He believes Great Britain will centralize production in Canada, if it can, although it may take two years to make a real "arsenal" of the Dominion. He points out that Britain's deficiencies in munitions tend to parallel our own (anti-aircraft artillery, for example) and that our defense program will utilize most of our munitions industry, such as it is. This means that the Allies will have to *create* capacity here and pay for it, which they will do only when their need is dire—as in aviation.

For the rest, *this source doubts that the Allies will place a single large order for guns, artillery, or ammunition here in the coming year.*

WE'RE A RESERVOIR

What does that leave? Commercial goods — food, clothing, blankets, trucks, motorcycles, ambulances, medical supplies, searchlights, telephones, radio equipment, and the like. And even in these fields, the Allies will buy first where credit and shipping conditions are easiest, i.e., in their own possessions, and in neutral nations where they can beat Germany to the punch.

Thus we remain a reservoir of supplies, to be tapped by the Allies only in case of need. Significant were the words with which Sir John Simon phrased his praise of our neutrality legislation before the House of Commons when he said: "The United States . . . have restored to us the *right* to purchase the abundant supplies which they are *able* to offer us." The italics are FACTORY'S.

Just what the Allies will be forced to buy from us only time will tell. Events have already belied the most logical of predictions. There has been no sudden outpouring of oil from these shores, for example. High octane gasoline and lubricants have had a boost but crude oil exports have actually fallen off. It will be a long time before England comes to us for copper, to mention another famous "war baby." Her first big order ($50,000,000) went to Canada. Not even the aircraft boom is a long-term sure shot for there again England's expansion trend is to Canada. We're in on that, of course, to the extent that many of our firms are building Canadian plants.

ORDERS AND RUMORS

How much actual war buying has there been here so far? A canvass of key sources brings to light many rumors, few facts. Outstanding fact is the $330,000,000-plus backlog of orders on the books of our aircraft manufacturers. U. S. government orders comprise some $220,000,000 of this. We have about 4,000 planes a-building now and we'll order more. The Allies are expected to buy 7,800 planes here within the year. More, perhaps, for Germany has reputedly boosted its own output to 2,500 planes a month—twice that of England and France combined.

Looking past the backlog, it is safe to assume that war buying will sustain the aircraft boom and absorb most of our full capacity, estimated as high as 1,700 planes a month, military and commercial. At that rate, spring should find 80,000 Americans at work in our plane factories (1938 average 45,000). And personnel managers will find it even harder to pluck skilled and semi-skilled men or even good apprentices from the long lines of job-seekers at their gates.

In the next most active industry, machine tools, many plants are booked to capacity for a year or more. American orders bulk large in the total but 1939 exports to England are surpassing the previous (1916) high. Little plant expansion has been reported, however. Here again, apparently, the foreign buyer will have to amortize new facilities if he wants the production badly enough.

Machine tool builders have met the rush of foreign business with very level heads. Long-range straight thinking governs the policies of many of the most influential producers.

"First of all, we are not going to forget our domestic customers," said one leading operator. "They were our bread and butter before this foreign business boom

began and they will be long after it's over. They come first with us. And if serving them means the occasional loss of a war order—why, we'll just have to lose it, that's all."

An appreciable part of the industry has shunned inflationary price policies, such as the writing of "protective" price clauses into contracts for future deliveries. Some —and this takes courage—are still basing their bids for orders deliverable six months or more hence on *today's* labor and materials prices. They realize that machine tool price increases, resulting from their attempts to outguess labor and the suppliers of materials, would add to the unnecessary spiraling of prices in general. They believe that if they are to be genuine statesmen in business they must follow the policy of pricing on present-day costs in the interest of their customers.

WHAT'S BEING BOUGHT?

Facts about foreign war purchases are not always announced officially but word of them gets about. The French official buying mission has opened an office in New York and has made random purchases of such things as 200,000 blankets, 6,000 mules, about 6,000 motor trucks, and, it is also reported, a New England shoe factory. French purchases of machine tools are averaging about $2,000,000 a week. The French are also said to have made inquiries concerning $100,000,000 worth of guns and ammunitions but no definite order has been placed.

One observer, who has been close to the situation, doubts that the French agents know, as yet, exactly what they came here to buy. In machine tools they have shown a tendency toward excited buying, bidding on the entire output of plants without apparent reference to specific needs.

In general, however, it is believed that the French will hold back on very big purchases until they can coordinate their activities with those of the newly-announced British Supply Board which is under the direction of Arthur B. Purvis, the Canadian industrialist who was on the supply job here in 1914–18. The only word of British munitions buying here so far concerns an order for gun carriages being built by the York Safe and Lock Company of York, Pa. A British official told FACTORY he did not expect any important shift from the present emphasis on planes and machine tools but foresaw a certain amount of buying in specialized accessory equipment, light forgings, castings, nuts and bolts, etc.

In the outskirts are a good many representatives of small neutral nations, hopeful of stocking up on armaments and planes here. Some are getting planes, but their hopes of buying munitions have been dimmed by the prospect of prohibitive prices. They cannot place orders large enough at scales high enough to warrant the creation of new plant capacity.

Whenever foreign buyers seek large quantities of munitions or other war materials they will be expected to confer with the new inter-departmental committee of the U. S. government, headed up by representatives of the Army and Navy Munitions Board. Our government's policy is plain. We will discourage purchases of arms at plants equipped to fill our own orders. We will encourage foreign buyers to develop new facilities here. And we will try to block the exportation of raw materials listed in our military manuals as "strategic." More than one U. S. firm has voluntarily turned down foreign orders for such materials in recent months. Unofficially, our government is said to have prevented the shipment of a quantity of rubber (a strategic material) to Russia.

Our exports to Germany have, of course, fallen away to nothing since the war began. A considerable increase in the purchases of Germany's neighbors suggests, however, that some of them may be shopping in her behalf. The September export figures did not indicate that Russia and Italy were acting for the Reich in this country; recent developments show that they may be doing so now. An American oil firm has had inquiries from Russian and Italian agents concerning very large orders within the last two weeks. The Russian move, no doubt, was made to increase Soviet supplies for the Finnish war, begun November 30.

BIG DRUG ORDER HINTED

Counter to most of the boom-discouraging reports is one rumor that may be more than a rumor. In an exceptionally well-informed and reliable quarter, it is said that the Allies are contemplating an order for drugs that would utilize the entire capacity of our present industry for two full years. For that matter, the Japanese are at present heavy buyers of surgical supplies, dressings, and related products.

THE SOUTH AMERICAN PROSPECT

Great expectations were expressed earlier this year for a sharp increase in our trade with the Latin-American nations. But there has been only moderate improvement so far. Government officials say privately that the idea has been oversold, that the fine potential Latin-American market for our manufactured goods is still blocked by the same old obstacle—lack of cash. If we do take over the South American markets abandoned by belligerent Europe, therefore, we shall merely be inheriting Europe's barter problem, with which we are not so well suited to contend.

If the Latin-American nations begin to get large cash orders from Europe, they will be in a better position to

trade with us. As it is, we should have to extend credits or alter our tariffs to get them into our market. This we may do, but there will be a fine fight in Congress about it first. So much for another factor which at one time seemed likely to contribute something to a boom of outside origin.

OUR OWN DEFENSE PROGRAM

Looking closer home, we do find undoubted business stimulus in our national defense program, now moving along at a $2,000,000,000-a-year clip. It will probably be boosted again next year. The new naval appropriations, if Congress approves, will call for $1,300,000,000 to augment our sea forces with three new aircraft carriers, eight cruisers, 52 destroyers, and 32 submarines, and to raise our maximum naval air strength to 6,000 planes. The current naval building program is being speeded up.

The War Department will ask for $1,700,000,000, will seek probably to complete its aircraft building program of 6,000 planes, and may increase the maximum of its air force still further. Meanwhile the Army's industrial mobilization planning has been definitely speeded up. The rechecking of 10,000 allocated plants (plants not now used for the purpose that can produce munitions and war supplies) has been placed on a one-year basis instead of three years. The specifications for educational orders of 55 "critical items" of munitions (i.e., those having no counterpart in ordinary commerce) have been completed. Within the year bids will be sought for educational orders on all these items. This year production was begun on only six educational orders but only $2,000,000 has been available for the purpose. Congress has since appropriated $14,000,000 more of the $32,000,000 needed to complete the program.

Larger appropriations will also be needed for the War Reserve of munitions and supplies designed to equip the Initial Protective Force (the Army's name for the spearhead of trained troops and militiamen who would meet the first shock of attack on our shores). The estimated size of the IPF has been boosted, incidentally, from 400,000 to 600,000 men.

"SPEND-LEND" IN THE OFFING

Thus the spotlight of industrial interest, after swinging briefly over the world scene, comes to rest on our home problems. Chief of these is that of sustaining the very genuine domestic upturn which began before the war.

An interesting feature of this upturn is the fact that it is apparently self-financed, rising and proceeding under its own power without shot-in-the-arm government spending or private capital backing. To survive, it must presently begin to call forth uninvested capital. Government economists are inclined, publicly, to disparage its chances for life.

"But you want to remember," said one of America's most respected industrial analysts, "that the build-up is soon to begin for a greatly enlarged defense program and a new spend-lend splurge. So first we must be made to feel uncertain and poor. If our fears are awakened, we will take the medicine more cheerfully."

Off the record, however, the government economists foresee a pretty good 1940. One of the foremost among them has been bold enough to predict an industrial production average (Federal Reserve) of 115 for the year. And the economists retained by private corporations are almost as hopeful, though most of them envision some falling-off at the start of the year.

At any rate when Congress meets, the biggest issue will still be that of economy versus "spending." We shall have to ask ourselves whether we need and can afford big new government expenditures that will mean kicking over the present debt limit of $45,000,000,000 now plainly in view.

That a decision will have to be made is indicated by the President's suggestion of a choice between a higher debt limit and larger taxes to support the probable new increase in defense expenditures. Opposition to lifting the debt limit has been pronounced. Congressmen commenting on the "pay as you go" idea, have proposed higher inheritance and gift taxes and lower income tax exemptions as a means of financing defense.

SUMMARY

And that is the news of "war business," subject to change without notice in the event that Europe should suddenly find itself engaged in intensive warfare—or at peace. By all the signs, the chief "war" buyers of 1940 will be, in the order named:

1. The United States of America.
2. The Allies.
3. Assorted neutral nations.

Thus we are still our own best customer. Always excepting any sudden change in events abroad, the eyes of American management may well continue to focus at home. Here are the cards we can see: We know that war solves no domestic problems. We know that the Federal Reserve production index is running along at 120-plus, 24 points above 1938. We know that the considered predictions of analysts point to a reasonably busy industrial year. There seems no need, therefore, for succumbing to pessimism simply because the war boom as such has not materialized. In fact, there is every encouragement in a business increase based on normal, natural needs rather than on emergency war needs subject to sudden collapse.

FACTORY
MANAGEMENT and MAINTENANCE
L. C. MORROW, Editor

Jobs to Be Done in 1940

EACH DECEMBER, industry's thinking projects itself into the year ahead. What are the major jobs to be done? What is the order of their importance? What are the probabilities that they can be done?

In this month of December, 1939, there are four jobs that seem to cry out for doing in 1940. They are, in the order in which we see their importance:

1. Revision of the National Labor Relations Act.
2. "Disestablishment" of the Labor Relations Board.
3. Revision of the Fair Labor Standards Act.
4. Elimination of labor's abnormal tactics as represented by the "slow-down."

The National Labor Relations Act in its present form is completely satisfactory to practically no one except its administrators and their underlings. The false assumptions upon which the Act is predicated, known to management and labor from the beginning, are becoming apparent to both Congress and the public. The fallibility of organized labor's political strength has been demonstrated. Congress has regained much of its forfeited independence. The probable composite effect of these factors points to the likelihood of Labor Act revision in 1940 if industry will campaign unrelentingly, but calmly and logically, to secure it.

Changing the personnel of the National Labor Relations Board is secondary in importance to revising the Labor Law. With a different law, the Board probably would have made quite different interpretations and would have given quite different decisions. Yet to such extent has the Board lost the confidence of all factions affected by its work, that its usefulness under any law has been impaired seriously. The factors tending to bring about changes in the Labor Law also will tend to bring about changes in the personnel of the Board during 1940. Add the effect of another important factor—the testimony that will be adduced by the House Committee now investigating the activities of the Board.

If these two big jobs are accomplished in 1940, it will be almost too much to expect revision of the Fair Labor Standards Act. This law has not excited the same amount of interest given the Labor Law and the Labor Board. Nor has it been in effect long enough to reveal its true character. Actually this law is affecting wages and salaries far above the minimums it was designed to protect. Its maximum-hour provisions are pernicious, as are some of its other requirements. Even so, "progress toward revision" is our guess for 1940.

The elimination of abnormal tactics on the part of labor will depend largely upon public opinion. It was public opinion that outlawed the sit-down, and probably it will be public opinion that stops the slow-down. The latter is not as spectacular as the former, and therefore is not as well understood. So far, the deliberate, premeditated slow-down has not been practiced extensively. If its use is greatly increased within a short time, to the detriment and inconvenience of the public, it will not take public opinion long to deliver the death blow. 1940, it would seem, is likely to witness both the maturity and the demise of the slow-down.

It is more than regrettable that industry must dilute its energies, all of which should be centered upon economical production, to combat these deterrents of prosperity. Yet, if our conclusions are correct, the task can be approached in 1940 with some measure of optimism.

L. C. Morrow

Whiting Williams

My One-Man

For years Whiting Williams has been making it is his business to know what's on the workers' minds —and he has obtained his results by living the life of the workers he studies. *Factory* readers will welcome this first-hand report of what he learned during his most recent month of "double life," but should remember that the article reflects neither the author's opinion nor *Factory's*. It is an unbiased report with a few inescapable conclusions

WHAT'S ON THE WORKERS' MINDS? How do those who have jobs feel about things in general and industry in particular? And, just as important: How do former workers and would-be workers feel? What do WPA-ers and the half-employed think about WPA? How do they feel about the New Deal—and John Lewis? What do bums and 'boes—also the better-type workers above them —think about the Reds, and Stalin, and Hitler? Are they growing more embittered and class-conscious than they used to be?

These were some of the questions which made me start off, a few weeks ago, on the same itinerary last covered in the summer of '32. That itinerary took me, in the guise of a needy job-seeker, to such centers as Chicago, Gary, South Bend, and Detroit—the heart of industrial America. It represented days and nights of talking with job-needers outside great factory gates, or of getting, while seated on curbstone or garbage can, the life history and the resultant industrial and political philosophy of numberless down- and near-outers. It also meant sleepless nights in all-night movies or around pathetic fires in city parks or listening to Red soap-boxers in "Bughouse Square," Chicago's famous open-air forum in front of the North Side's Newberry Library.

This recent month of questioning and listening included the same kinds of people in most of the same spots. The chief difference was that it seemed worth while to include the employer. So coatless, tieless, shaveless mornings were often combined with better appareled afternoons, along with evenings in saloons or among the soap-boxers.

These weeks of the "double life"—of a sort of one-man Gallup Poll—produced the observations set down in this article.

First, all the people I met on the lower level of our society were in the grip of complete hopelessness.

"Where can I find a job?" This query, everywhere encountered in 1932 has given way to "How can I get back on WPA?"

Everywhere in these lower levels all hope of America's ever again enjoying full prosperity appears gone, "unless, of course, we go to war and then we'll have to go through it all over again!"

How come? What makes them all so certain that private industry will never again hang out any "Men Wanted" signs? The answer is simple: "You see, Wall Street and the rich and well-to-do make just as much money in bad times as in good. All the money that the rest of us lose gets finally into *their* pockets. And to make more profits, these Money-bags keep buying more and more *machines*."

"Dees goo-od countree," so a Chicago Greek put it. "Ver' bad dat people go hoo-o-ngry because too much machine work and not enough men work!" Like every victim he buttressed his conviction by his personal observation: "My bruder he work long, long time—mebbe fourteen year—same place. Year ago companee buy machines—now only two, t'ree day week."

Needless to say, he would find it hard to understand that those machines were perhaps all that made possible even those "two, t'ree days."

Luckily, part of this hopelessness is caused by this rather encouraging

Poll of Worker Opinion

change: WPA and the "WPwAy of life" are now much less satisfying than a few years ago. They are now seen as nothing but mere subsistence, "dead living" as one foreigner put it—endurable as an emergency shot in the arm, but far from satisfactory on any permanent basis.

That, of course, is a good sign. But it only makes all the more disquieting the tragic fact that today few of WPA's beneficiaries have the courage to hope for anything except *more of those same shots.*

The second outstanding change is this: The newly made rules and reductions in WPA, along with the continued volume of unemployment, appear to have considerably lessened the popularity of President Roosevelt.

"We're splitting off from the Workers Alliance," a Chicago radical explained to me. "We're forming the Workers Security Federation of America. You see, the Alliance is run by Communists. But, for political purposes, the Communist Party won't let 'em blame the WPA cuts on Roosevelt. So we're getting in shape to fight him!"

The Kiss of Death

He put his finger on a pin-point that may prick and explode Mr. Roosevelt's chances even if war and war prosperity proceed to favor his running. This pin-point may perhaps be furnished by the huge enthusiasm with which the Communist Party is greeting Mr. Roosevelt as *their* candidate.

But Mr. Roosevelt is by no means the only one who should do some worrying about another very significant shift—a shift in Communist program and strategy. The Red strategists are now saying nothing about the idea of overthrowing capitalism by means of the old Marxian revolution of blood and bullets. Instead, the plan is now to destroy capitalism by *anemia.* This is to be accomplished by a brand-new form of class division. On one side are to be all the tax-*eaters*—WPA-ers, reliefers, pensioners, down-and-outers, many social workers, also many of those now on government payrolls. On the other side are the tax-*payers*—all the rich and well-to-do, "the people who grow richer and richer whether you and me are hungry or not, who use machines that destroy jobs and make us hungrier. All these people, of course, hate Roosevelt's guts because he turns on the heat and makes 'em cough up the money for feedin' us 'boes and other non-producers."

Between these two great classes this battle to the death is to be fought at the polls. The Marxian bullets of class warfare are to be displaced by the ballots of political wangling. But the result is to be the same—the taking over of all control by and for the sole benefit of the non-possessing and the non-producing proletariat.

When Whiting Williams became vice-president in charge of personnel for a Cleveland steel company, he found he knew too little of the problems confronting its 4,000 wage earners in their daily associations in shop and community. So he changed his name, donned overalls, and became a laborer in America's mines and factories. That was in 1919. He repeated the experience four years later in Britain, France, and Germany; visited Russia in 1928; spent the summers of 1930, '31, and '32 among the jobless workers of this country; revisited the worker districts of French industrial towns in 1938; has only recently completed the "one-man poll" described in this article. Throughout his researches, and in his work as industrial consultant, author, and lecturer, Mr. Williams has aimed to exert the helpfulness of the unbiased observer. In the snapshot below we see him in one of his many worker disguises

Out the Back Door

Unfortunately, any careful observer is bound to see signs that should give joy to the master planners of this effort—and them only.

Thus, for instance, Chicago is only one of numerous cities where it is evident that, while its outward appearance is being greatly improved by recent federal expenditures on great bridges, imposing boulevards, and renovated parks, its smaller business men and industrialists appear to be leaving by the back door. Even to the eyes of ignorant but troubled workers it appears plain that it is becoming almost daily harder for any but the very biggest and strongest concerns to stand the gaff of high federal taxes, high local taxes, multitudinous government reports, government-initiated legal disputes, and government-fostered labor trouble.

Altogether, it takes no college education for anyone to see that while the country's *public* plant of government buildings and government-built roads and structures, is "in the pink," its *private* plant of small factories, homes, garages, and yards appears "in the red." It does look as though the New Deal's plans

for spreading the abundant life out to the edges for the benefit of the marginal employer and the marginal employee were in actuality working today in *exactly the opposite* direction. Only those establishments and only those individuals in full possession of wide-margined assets of money, brains, skill, and craft appear to be able to "take it" standing up.

"When," explains the Socialist, "all business has been boiled down to a few big concerns, it will be easier for the government to take over and run everything."

"'Twon't be so very long now," the smiling Communist assures you, "till a jobless and hopeless proletariat will know how to vote—or, if need be, to fight."

These, I submit, represent some very important and disturbing shifts.

No wonder I found it a blessed relief to visit a number of small towns. Some of these are today living largely by WPA—on the subsistence level of the public payroll. Few of them are happy. A gratifying proportion of their citizens will tell you how "we're seeing it all make loafers out of men who used to be good citizens." A gratifying number will tell you also how they find it difficult to understand "how they can do so punk a job of administering relief. Lots of people here have to go every day to their WPA jobs in B——, fifteen miles away, while plenty of people from B—— have to come to work every morning on our WPA project here!" A gratifying number of ordinary workers, also, will tell you how "It's us fellows that have to pay more for our bread and rent and what not on account of those PWA-ers."

Support for the Communists

But great numbers of even these good citizens find it hard not to share the hopelessness of my fellow-bums of the city. The reason is different but, alas, it only supports the scheming of those Communist politicians.

"But is there any chance," these ask, "that we won't be permanently out-voted by all these demoralized reliefers, tax-leaners, and government employees?"

Who can say? I only know—or at least feel sure—that by no means all those WPA-ers enjoy their "dead living" well enough to refuse to take a chance at voting for a change—even though that chance does appear to hundreds of thousands of them as an extremely long one. Altogether too many of those on relief have lost their hope, but by no means have all of them lost as yet their self-respect.

And it has to be observed that both hope and self-respect have been revived by the talk of war. Practically all pray that we may not be involved. But few of the jobless can keep from hoping that we may somehow contrive to enjoy more demand for workers and still skirt safely the abyss of participation.

In the field of labor and management the changes to be noted are numerous but decidedly less disturbing.

Most workers, I'd say, show less and less use for John Lewis, appear tired of fighting, want to be let alone, hate to pay any dues. Many committees formerly in favor of work-sharing are now against it. They now ask 40 hours for long-serviced men. "Let the others go on WPA or take a war job."

Management is handling workers better—doing a much better job of observing seniority (as to lay-offs, not promotions), training foremen, adjusting grievances, classifying jobs and rates, favoring proper differentials for skill and responsibility.

As a result, "member" issues—individual worker complaints—have grown much smaller and collection of dues harder. Of this last the reports, particularly in the newer CIO organizations, appear all but universal. Of this, in turn, the further result is a notable increase in "leader" issues and leader strategy.

The best union brains are now instructing all local leaders how to get around poor dues collection by pushing hard for:

1. *Company-wide* (not plant-wide) agreements.

2. *Closed shop*—under many guises, such as union shop, preferential shop, preferred (union) seniority, "harmony clauses."

3. *"Union Label"* on tools and materials—under threat of striking and tying up the suppliers thereof.

4. *More union control*—e.g., prohibition of all "assistant foremen," election of "group leader" by his gang-members, plus prohibition of discharge except with his approval. In many places dues are now collected, with or without permission, on the job.

The Same Old Problem

These top-instructed local negotiators often outwit the single, less experienced employer. Nevertheless, I saw nothing and nobody to change my conviction that the problem's crux remains the same as always: *How the individual worker is handled by—how he feels toward—his employer.*

"Too damn many here," a local leader supported this conviction, "want to ride the union horse without paying a cent for any of the oats. What burns me up is the way they run to me for help the minute they have a grievance."

It is evident, however, that this crucial job of properly handling the individual worker is now made harder than ever by the way many working forces today include high school grads alongside extremely ignorant workers—also, too often, under ignorant, "hand-over" foremen.

"For t'ree year no can work," thus a Gary worker furnished me with a prize demonstration of ignorance, "because now no got-em foot. T'ree year ago, when feet sore, all friends tell me what medicine for put on. Pretty soon have all kinds—100 bottles. One night dream dream. Somebody tell me in dream pour all hundred togedder for put on feet. Next night—do. Next morning—great big blisters. T'ree day later—

(*Continued on page* 124)

How Industry Looked to Whiting Williams on His One-Man Poll

BAD IMPRESSIONS

1. Factory office entrances needing paint, broom, elbow grease.

2. Office information desks manned by hard-boiled guards wearing super-military uniforms and carrying revolvers.

3. Offices that require visitor to talk through small glass hole or high wire fence before policeman unlocks gate.

4. Bulletin board still carrying statement issued during strike in January, 1937.

5. Dirty saloons across from factory gates. ("If you turn on that nickelodeon, the gateman may mosey over and order me back to my job inside.")

6. Factories whose personnel man has not yet seen union contract signed weeks before by out-of-town vice-president.

GOOD IMPRESSIONS

1. Exhibition of new yearly models to employees and their families.

2. Property opposite plant gates purchased by company and saloons closed.

3. Pleasant information-desk girl who recalls second-time callers.

4. "Visitors Welcome" sign outside plant entrance—plus attractive lawns and spotless offices.

5. Employers doubling efforts to explain company's problems or real job-creating advantages of machines.

British Industry and the War

Although this still simmering struggle called a war was but seven weeks old when the Clipper delivered this first-hand report, governmental intervention in Britain had already made itself felt in the control of labor, materials, prices, and profits. The plight of British industry today constitutes fair warning of what may very well happen to any industry when a democracy is forced to go to war

URSEL BALIOL SCOTT

Secretary, British Management Council

For a young man of not quite 27 years Ursel Baliol Scott has covered a lot of territory and seen a lot of industry. As private secretary to the Rt. Hon. Viscount Leverhulme from 1935 through 1938, he was intimately associated with the latter's activities as president of the International Committee of Scientific Management, acting as liaison officer between Lord Leverhulme and the affiliated management societies in some twenty countries, both in Europe and America, and traveling more than 30,000 miles in the fulfillment of this mission. He was also European executive secretary to the Seventh International Management Congress, held in Washington in September, 1938. Mr. Baliol Scott has been secretary of the British Management Council since its inception in 1937. During the past year he was secretary of the management committee at Streetly Manufacturing Company, Limited, a subsidiary of British Industrial Plastics. Right now is reorganizing the office routines of the Czech Refugee Trust Fund, which is maintaining, training, and finding work for some 9,000 Czech refugees under a $10,000,000 grant from the British Government

ALTHOUGH THE GREAT WAR may have failed to make the world safe for democracy, it went far towards the democratization of industrial life. If the tide of progress receded in the years of depression and disillusionment of the early twenties, it nevertheless left behind it a vastly altered outlook on the techniques of production management and an increased awareness of the importance of the human factor in manufacturing industry.

Today Great Britain is again at war, and the consequent and sudden pressure for social, economic, and technological change is likely to be no less decisive in shaping Britain's future industrial history than it was during the Great War.

It has in recent months become fashionable to picture Great Britain as already having been at war, or at least not at peace, for some years, and it is true enough that the national war effort did not start on September 3, 1939. This effort first became perceptible some four years ago. For a long time it languished through the inertia born of a peace-loving nation's reluctance to turn its energies to the production of intrinsically worthless munitions of war, but in recent months, and more particularly since the Munich agreement, the tempo of national preparedness has been sharply accelerated. On the one hand a great increase in the output of war materials was achieved in the post-Munich period; on the other, detailed plans were being laid against the day when it might be necessary to switch the nation's economic and social life on to a war footing overnight. The tempo of modern war is vastly quicker than it was a quarter of a century ago, and it was clear that Great Britain could not again afford a lapse of two years before achieving a national effort comparable to that reached in 1916.

Thus it has come about that during the first weeks of war legislation has been passed of a character quite as far reaching as that which was achieved in the first two years of the last war. On Monday, August 28, no fewer than 96 regulations affecting most aspects of civil life were passed under the newly created Emergency Powers (Defense) Act, followed by another 32 during the course of the same week. Since then there has been a steady although gradually diminishing stream of Acts of Parliament, Orders in Council, and Departmental Instructions—the great majority of which, in peacetime, would have involved prolonged discussion and keen opposition, but which in the national emergency were allowed to come into force unchallenged.

Customer or Owner?

The impact of governmental intervention upon industry has already made itself felt in the control of labor, materials, prices and profits, transport, and imports and exports. Thus, while the machinery of production continues to remain outwardly at least on a private ownership basis with the government as the customer rather than the owner of British industry, the government has in fact imposed restrictions and controls upon the normal functioning of industry at so many points that production programs are deeply affected by governmental action.

None can doubt that ultimate responsibility for wartime production rests with the government, and that in effect British industry has for the time being become nationalized (except when it comes to paying the bill, for which purpose industry remains on a private enterprise basis). Furthermore, it is an elementary principle of good management that responsibility should carry with it the authority necessary to the accomplishment of the task. Thus while "collaboration" between the government and essential industries may prove satisfactory and sufficient, Parlia-

Photographs from Ministry of Information and Fox Photos Ltd.

Assembling Bristol Blenheim 300-m.p.h. bombers in a Liverpool plant, which stands on what was, less than two years ago, a cabbage patch. Today the company has some 6,000 employees, its capacity having been increased 40 per cent over the rate originally planned

ment will certainly look to the government to take action in time to avoid repetition of the catastrophic supplies muddle of the last war.

It is, nevertheless, an open question whether the government should at this stage attempt to undertake the planning and control of industry as a whole, or even of specific industries, if only because it is not yet equipped to do so. The Ministries of Supply, Food, and Economic Warfare are only a few weeks old, and can hardly be said to have an intimate understanding of all the industries over which they must exercise powers of one sort or another. The Ministry of Shipping has only just been launched. Greatly increased burdens have been placed on the Treasury, the Board of Trade, and the Ministry of Labor. Furthermore, the departmental interests of each of these ministries and of the three armed forces must in the nature of things diverge both frequently and sharply.

In short, before the government can undertake any effective national planning of industry, it has on its hands the large and immediate problem of absorbing its new recruits and getting its new machinery into working order, and thereafter of determining and reconciling the requirements of its various ministries. Rapid adaptability has never been pre-eminent among the qualities of the British Civil Service so that the running-in of the new machinery of government is going to be no easy task, and it is probably for this reason that during the first weeks of the war nothing was done, at any rate publicly, to grapple with the larger problem of national economic planning.

However, on October 9 the Prime Minister announced to the House of Commons that a committee had been set up under the Chancellor of the Exchequer, composed of the ministers of the departments concerned with the various aspects of the economic direction of the nation's war effort. This committee is to keep under review and to coordinate the working of the various ministries.

Views Problem Impartially

In addition there is now in operation an interdepartmental committee composed of the permanent civil service heads of the ministries concerned, and presided over by Lord Stamp, Chairman of the London, Midland & Scottish Railway, and an eminent economist, who is himself free from departmental duties and thus able to view the problem of coordination impartially. It is no doubt in this latter committee that the effective working out of coordinative measures will be performed.

The attitude of organized labor has during the past weeks been highly cooperative, and in this respect parallels the experiences of the last war. Plans are far advanced for the formation, under the chairmanship of the Minister of Labor, of a national advisory council of employers and trade union leaders to advise the government on matters affecting labor during the war. It is proposed that the council's terms of reference shall go beyond matters of hours, wages, and other conditions of work, and embrace the broad issues involved in securing industrial output for the war.

In recent weeks several unions have been in negotiation for wage increases consequent upon the sharp rise in the wartime cost of living. A national scaling up of miners' wages has been agreed on, and this is likely to be followed by similar agreement in other industries.

An immediate consequence of the war has been a sharp increase in unemployment in a considerable number of trades supplying consumer goods and services. The increase has been mainly among women, the increase among men having been obscured by the mobilization of the Territorial Army and other defense forces. The heavy

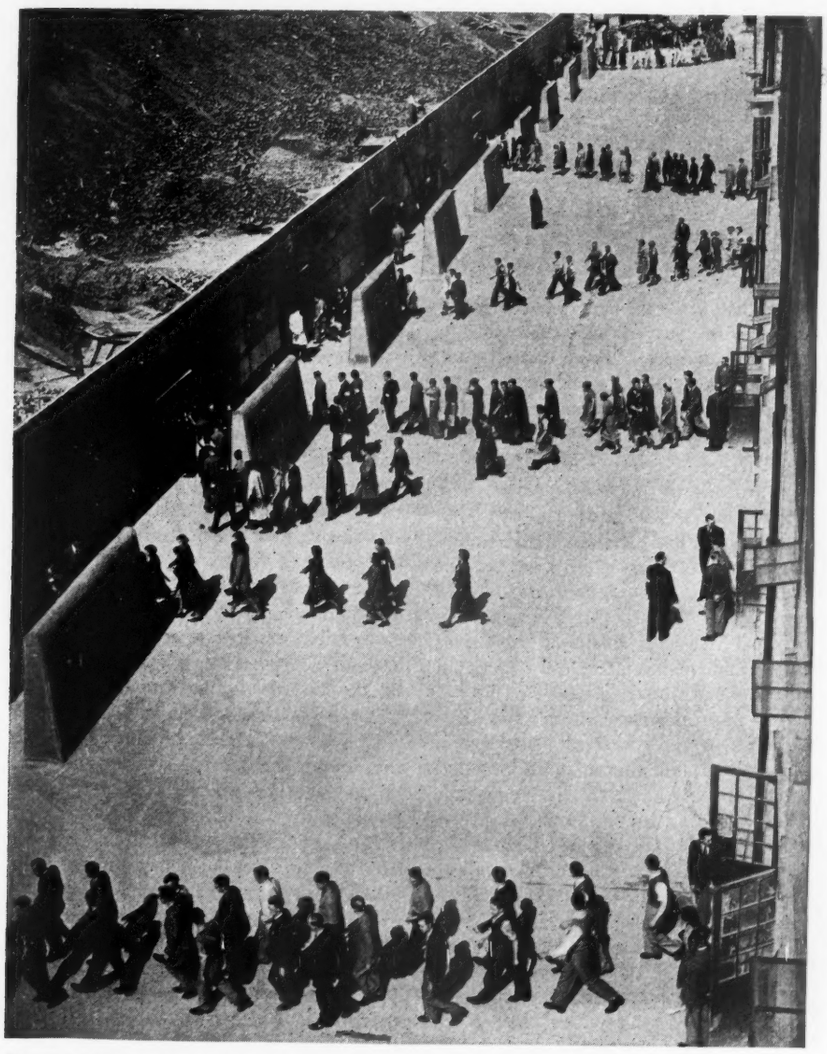
industries have, on the other hand, shown a decrease in unemployment. The "Economist" index (adjusted to eliminate seasonal fluctuations) puts the net increase in unemployed insured workers between August 14 and September 11 at 8½ per cent, to which must be added a sizable increase among earners above the £250 level not included in the unemployment returns.

While the outbreak of war has thus produced acute short-term dislocation of labor and consequent hardship, this condition is overshadowed by the long-term problem which will, given a prolonged war, be precisely the reverse—one of shortage of labor. Indeed, the determining factor as to the extent of the national effort will be its available manpower, and the most efficient utilization of this national asset thus becomes a matter of the first importance. Under the National Registration Act, for example, a national register of the entire population has been carried out. One purpose of this will be to classify and measure the nation's manpower.

Although under the National Service (Armed Forces) Act all able-bodied men between the years of 18 and 41 (other than clergy and conscientious objectors) are liable to military service, the mistake of mobilizing the workers in key industries has not been repeated, and a long schedule of reserved occupations, erring if anything on the side of comprehensiveness, has been compiled. In some cases occupations are only reserved above the age of 30 or 35, and in other cases they are totally reserved.

A wartime measure of considerable constitutional importance is the Control of Employment Bill which aims at regulating the hiring of employees to insure the best use of manpower by preventing the poaching of key workers. The bill can, at the discretion of the Minister of Labor, be made applicable to all classes of employees (manual, technical, and professional), but initially it is proposed that orders shall only be issued affecting certain limited categories of skilled workers. Workers in the categories to which the order is made to apply may not be advertised for, engaged, or re-engaged by employers except with the permission of the Ministry of Labor. The interests of employer and employee are safeguarded by the provision that the Ministry of Labor shall consult with the British Employers' Federation and the General Council of the Trades Union Congress before issuing orders.

Although no legislation is yet in hand providing for the dilution of labor in organized trades during the course of the war, an agreement has been reached between the Engineering and Allied Employers' Federation and the Amalgamated Engineering Union whereby semi-skilled men may be substituted for skilled men where production is hampered through an insufficiency of the latter. The Amalgamated Engineering Union with its membership of 400,000 has always resisted dilution in peacetime as stoutly as any union, and its decision, reached entirely voluntarily, is thus significant.

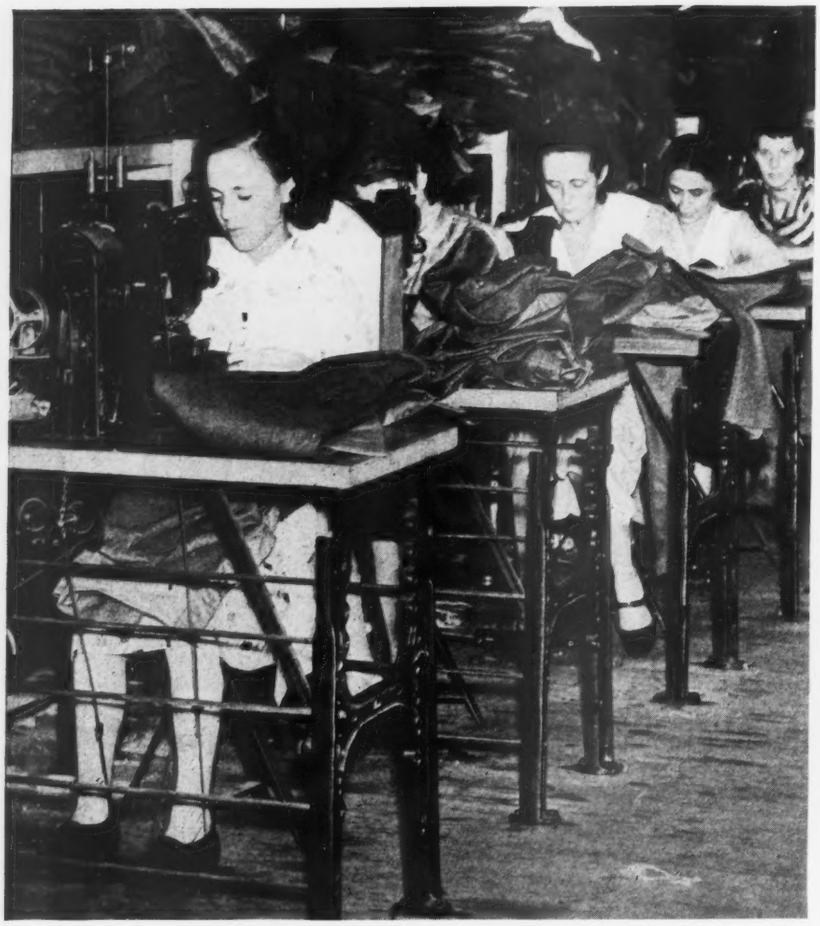


Air raid drill at Southgate Works of Standard Telephones & Cables, Limited, London, where 6,000 people evacuate the plant in 7½ minutes, moving in orderly fashion to the underground shelters. Note concrete barriers designed to protect shelter entrances

Playing a Traditional Role

The machinery for collective bargaining remains largely unchanged, with the Ministry of Labor occupying its traditional role of lubricant between employers and unions. While the necessity has not yet arisen for the ministry to take upon itself any coercive powers (and indeed neither does the experience of the last war nor the present national unity lead one to suppose that the necessity will arise), it must not be supposed that the ministry would stand by and permit the normal machinery of arbitration to run its course if a stoppage arose that seriously threatened the war effort.

In common with the rest of the nation's manpower, management is being mobilized. In this connection an interesting and highly controversial piece of work undertaken by the Ministry of Labor is the compilation, with the assistance of the appropriate professional bodies, of a central register with about 100,000 names of persons with administrative, professional, and technical skills who are able to undertake work of national importance. It is intended that this register should be used in making all appointments to government departments; beyond that



The tremendous task of clothing Britain's new armies has brought employment to many thousands of British unemployed. Over 600 people are at work in this Bolton clothing factory making uniforms for the militia. This is a single-story plant laid out for straight-line production from the receiving department where khaki cloth by the mile is stored, all the way to the point where the finished uniforms are packed and shipped

it is at the disposal of any employer doing work of national importance.

The conception of the Ministry of Labor operating as a national personnel department is in theory a sound one, but in practice the operation of the register is encountering difficulties, more particularly in evaluating the qualifications of candidates in terms of the requirements of a job; and in determining priorities as between two or more posts of a similar character.

In connection with the staffing of government departments, the Ministry of Labor is at present taking the surprising attitude that persons whose administrative and executive training has been of an industrial character are not as a class particularly suitable for wartime civil service appointments, and that more satisfactory sources are pensioned civil servants supplemented by members of university staffs.

It is true that a number of leading industrialists are to be found in the civil service at the present time, but they are mostly men who owe their appointment to the authoritative positions they hold in their respective industries rather than to their management qualifications, although these are in many cases outstanding. The large body of first-class business executives remains unconsidered in the staffing of the wartime ministries.

Very naturally the British Civil Service seeks to safeguard the interests of its members, and this attitude is consequently in part an instinctive resistance to dilution, and in part a social prejudice against the business executive whose educational, intellectual, and social background in many cases differs widely from that of the civil servant who has been trained in the conservative tradition of the older universities and promoted in the main by seniority. It is nevertheless a policy that is depriving the machinery of government of much first-class administrative and executive talent.

The professional management consultant is also being looked upon with little enthusiasm even by the more chaotic of the government departments, but it is interesting to record that contracts among private industrial concerns continue to be well booked.

A comprehensive range of raw materials are being strictly rationed by the Ministry of Supply, while the Ministry of Food is doing the same for foodstuffs. Purchasers continue in the main to secure supplies of raw materials through normal market channels, although as a rule purchases may only be made subject to license from the Ministry of Supply. Exports of raw materials are also subject to license. Rationing is on a priority basis, government contracts coming first.

To Hold Customer Good Will

The government is also endeavoring where possible to insure that raw materials are readily available to factories manufacturing for export. Indeed, at the outset of the war official recognition was given to the importance of maintaining exports both to offset inflated war imports and to hold customer good will pending a return to peacetime trading.

With the introduction of rationing over a wide range of raw materials and foodstuffs, it has proved possible to fix and maintain, subject to periodic alteration, maximum prices for these commodities. Prices of some raw materials have been maintained well below ruling world prices.

Due, however, in part to rising costs, in part to the government's scheme for compulsory war risk insurance, and in part to incipient profiteering, the general trend of prices has been upwards, and the rise in the cost of living since the outbreak of war is already being put as high as 10 per cent. War risk insurance of goods for sale has been made compulsory where their value exceeds £1,000, the risk being carried by the Board of Trade at 6 per cent. Some firms have taken this as an excuse to raise prices far in excess of the amount necessary to cover the premium—a very small percentage on goods with a quick turnover.

Mainly as a result of this type of profiteering, active steps are being taken to penalize the entrepreneur who derives unfair profit from the national emergency. The Prices of Goods Bill, at present before Parliament, provides for a number of fairly ruthless anti-profiteering measures. Under this bill the Board of Trade is to establish "permitted prices" for a wide range of commodities based on the prices obtaining on August 1 plus additions to cover

increases in production and distribution costs. The bill provides for the fining (up to £500) and the imprisonment (up to two years) of persons violating the "permitted prices," and repeated offenders may be prohibited from carrying on their businesses.

It remains to be seen whether such measures will prove more successful than did the anti-profiteering measures in the last war. It seems likely that the small operator will be effectively controlled, but it is more doubtful whether the profits of the large-scale contractors supplying the fighting services can be controlled on the "cost plus" basis, which is prevalent in contracts of this type.

Tax on Excess Profits

However, any would-be profiteers who escape the vigilance of the Board of Trade still have to reckon with the Chancellor of the Exchequer, who on the basis of his emergency budget plans both to tax incomes at over-all rates varying from 7 shillings in the pound for incomes of £3,000 up to as much as 15 and 16 shillings in the pound for incomes of over £100,000, the latter representing a tax of over 75 per cent. He has also announced a tax of 60 per cent on company profits in excess of recent peacetime profits.

A new function that has made its appearance in the factories and offices of most companies is that of Air Raid Precautions. The Civil Defense Bill requires all industrial and commercial undertakings that employ more than 30 persons to insure that the personnel necessary for first aid, anti-gas measures, and fire fighting shall be trained and equipped up to definite standards, and that employees shall know what to do in the event of an air raid.

During the early weeks of the war the most visible consequence of ARP has been the rigid blackout which has been imposed throughout the country. Blackout regulations have necessarily hampered—and in some cases stopped—the out-of-doors work of factories and have called for considerable care in shielding factory lights. The blackout has had a depressing effect on retail trade, which may become progressively more noticeable as the days get shorter despite the extension of summer time until the middle of November. There is also a tendency to revise hours of work to enable employees to get to and from their work in daylight.

As in the last war many factories can be expected to introduce wartime modifications and improvements in management that will become permanent, but such changes do not come overnight, and it must be some months before tendencies can become apparent in this respect. There are, however, a number of instances in which it has been necessary for factories intending to accept government contracts to spend considerable time in re-equipping their plants and in training their personnel before production could be begun.

A decontamination squad mops up during an air-raid practice drill in one of Coventry's larger plants. This anti-gas unit is fully equipped and trained for every emergency

In reviewing the effects upon industry of the first seven weeks of the war it has been necessary to do so almost entirely in terms of the legislative and executive acts of the government. Never before in the history of British industry have so many far-reaching restrictions been imposed upon free enterprise in so short a time and with such lack of opposition. Furthermore, British industry can be relied on willingly to submit to yet more rigid control so long as it can be seen to be achieving a useful purpose and so long as it is confidently believed that the control will be relaxed after the war as readily as it has now been imposed.

At best a widely controlled economy can in terms of sheer efficiency represent a big advance over a free economy. At worst the difficulties involved in, and the administrative and executive qualities required for, the operation of a controlled economy can result in a breakdown in bureaucratic intervention as disastrous to the conduct of a war as a major defeat in the field. The British Civil Service has upon its shoulders today a task calling in the highest degree for qualities of straight thinking and incisive action. Upon the ability of the Civil Service to find such men within its ranks, and upon its readiness to search for them elsewhere whenever they are not forthcoming from within these ranks, will largely depend the speed and decisiveness of the victory of the Western Powers in the present ideological struggle.

IN JANUARY

FRENCH INDUSTRY AND THE WAR

Payroll Reporting Made Easy

Payroll records must meet the requirements of (1) Wage and Hour Act, (2) amendments to Social Security Act, (3) your own state's unemployment compensation law. If you must revise, examine this simple procedure which needs but a single operation on a bookkeeping machine

EUGENE CALDWELL

Consulting Management Engineer, Milwaukee

TWO FEDERAL LAWS PASSED RECENTLY require that the payroll records of most companies be revised. The first of these laws is the Fair Labor Standards Act of 1938, otherwise known as the Wage and Hour Act. The other is the 1939 Amendments to the Social Security Act. Both of these acts prescribe certain details that must be made part of the payroll records of any plant.

A third law limiting the payroll records is the unemployment reserve law of the particular state where your plant is located. Most of the state unemployment reserve laws are satisfied, however, if a record is kept of the number of hours each employee works each week and his earnings for the week.

A satisfactory payroll record, therefore, must take into account the requirements of all three laws. It is no easy job to get a simple record that will satisfy all three of the statutes.

The Wage and Hour Act provides that the payroll records should show the name of the employee in full, his home address, date of birth, hours worked each work day and work week, the regular rate of pay and bases upon which wages are paid, wages earned at regular rate, overtime wages, deductions, total wages paid, and the date of payment. An interpretive bulletin issued by the Wage and Hour Division of the U. S. Department of Labor still

PLANT PAYROLL TREASURER'S CERTIFICATE REGISTER

TIME WORKED		HOURLY DAY RATE	AMOUNT EARNED					AMOUNT SUBJECT TO TAX	DEDUCTIONS				DATE WAGES PAID	CERTIFICATE NUMBER	CLOCK NUMBER
DAYS	HOURS		HOURLY RATE	OVER-TIME	PIECE WORK	BONUS	TOTAL		FEDERAL OLD A. TAX	GROUP INSURANCE	MISCELLANEOUS REASON	MISCELLANEOUS AMOUNT			

PLANT EMPLOYEES EARNINGS RECORD — YEAR

NAME: ADDRESS CLOCK NO.

OLD RATE LAST APPLIED SOCIAL SECURITY NO.

WEEKLY BENEFIT RATE { NOW $ / PREVIOUS $ } IN WEEK NO. GROUP INSURANCE NO.

WK. NO.	TIME WORKED DAYS	TIME WORKED HOURS	HOURLY DAY RATE	AMOUNT EARNED Hrly. Rate	OVERTIME	PIECE WORK	BONUS	TOTAL	AMOUNT SUBJECT TO TAX	DEDUCTIONS FEDERAL OLD A. TAX	GROUP INSURANCE	MISCELLANEOUS REASON	MISCELLANEOUS AMOUNT	DATE WAGES PAID	CERTIFICATE NUMBER	CLOCK NUMBER
F2																
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																

NEITZEL MANUFACTURING CO.
MILWAUKEE, WIS.

DAILY REPORT OF SALARIED PERSONNEL

DEPARTMENT _____ DATE _____ 19____

ESTABLISHED HOURS OF DEPARTMENT: FROM _____ A. M. TO _____ P. M. TOTAL _____ HRS.

MADE OUT BY _____ APPROVED BY _____

ABSENT OR WORKED LESS THAN ESTABLISHED HOURS				WORKED MORE THAN ESTABLISHED HOURS			
NAME	TOTAL HRS.	TOTAL MIN.	REASON	NAME	TOTAL HRS.	TOTAL MIN.	REASON

NEITZEL MANUFACTURING CO.
MILWAUKEE, WIS.

STATEMENT OF EMPLOYEE'S EARNINGS AND DEDUCTIONS

TIME WORKED		HOURLY DAY RATE	AMOUNT EARNED					AMOUNT SUBJECT TO SOCIAL SECURITY TAXES	DEDUCTIONS				DATE WAGES WERE PAID	TREASURER'S CERTIFICATE NUMBER	EMPLOYEE'S CLOCK NUMBER
DAYS	HOURS		HOURLY RATE	OVER-TIME	PIECE WORK	BONUS	TOTAL		FEDERAL OLD AGE TAX	GROUP INSURANCE	MISCELLANEOUS REASON	MISCELLANEOUS AMOUNT			

NOTE: ENTRIES ON TOP LINE ARE FOR WEEK ENDING AT 12:00 O'CLOCK MIDNIGHT TWO SATURDAYS BEFORE DATE WAGES WERE PAID.
ENTRIES ON BOTTOM LINE ARE FOR WEEK ENDING AT 12:00 O'CLOCK MIDNIGHT THE SATURDAY BEFORE DATE WAGES WERE PAID.

RETAIN THIS RECORD. IT IS A STATEMENT OF YOUR EARNINGS AND TAX DEDUCTIONS REPORTED TO FEDERAL AND STATE GOVERNMENTS AS REQUIRED BY LAW.

further explains these requirements.

The sample forms shown comply with these requirements after certain explanations are made. The record is intended to cover only those data that change at regular intervals. It is expected that another record of each employee will be kept containing the more or less permanent or unchanging data, such as date of birth and home address.

However, the record shown does not comply with the requirement that the hours worked each day must be part of the record. It is expected that time-clock cards will be held available for inspection in case the exact time worked on any particular day should be desired. Permanent records become too bulky when an attempt is made to show the detail of the daily time worked by each employee. As a matter of fact the regulations of the administrator suggest that it is not required to show the hours worked each day on the payroll form so long as the data are available in some other form.

The sample forms shown are designed for bookkeeping machine posting. A payroll check register is made out, the actual check and a receipt for the employee are prepared, and an employee's earnings ledger sheet is posted—all in one operation. Essentially, just one form is used because the columnar data on the check register, employee's earnings record, and employee's receipt are the same.

The form provides a column for the rate at which the employee is paid, as required in the regulations. Also shown is a column for earnings at overtime rates, which must be separate from regular hourly earnings.

Picture of Efficiency

A separate column for piecework earnings is not required by the regulations, but this has been provided for management information. A clear picture of the efficiency of the employee for the entire year can be gained by observing this column on the employee's ledger sheet.

The amount taxable column has been provided to indicate what portion of the wages are subject to social security taxes. If the total earnings for the year are less than $3,000, this "amount subject to tax" column will show the same figure as the total earnings column. After the $3,000 point has been reached, the entry in the "amount subject to tax" column will be zero. The columns for social security tax reductions and for other deductions are in accordance with requirements of the regulations.

Practically every state law relating to unemployment reserves requires that earnings be computed for each calendar week. Many companies, because the entire payroll had to be figured weekly anyway, went to weekly paydays. This is not necessary, however, for paydays can continue to be every other week if desired. Nevertheless, most concerns that formerly paid twice a month, say on the first and the fifteenth, found it advisable to pay every fourteen days to avoid figuring the payroll on two different bases.

The form shown was designed for paydays every two weeks. Data of earnings and deductions are recorded weekly, but the check and data pertaining thereto are made out only every other week. In other words, the entire posting operation is done only every two weeks at the time the actual payroll checks are made out.

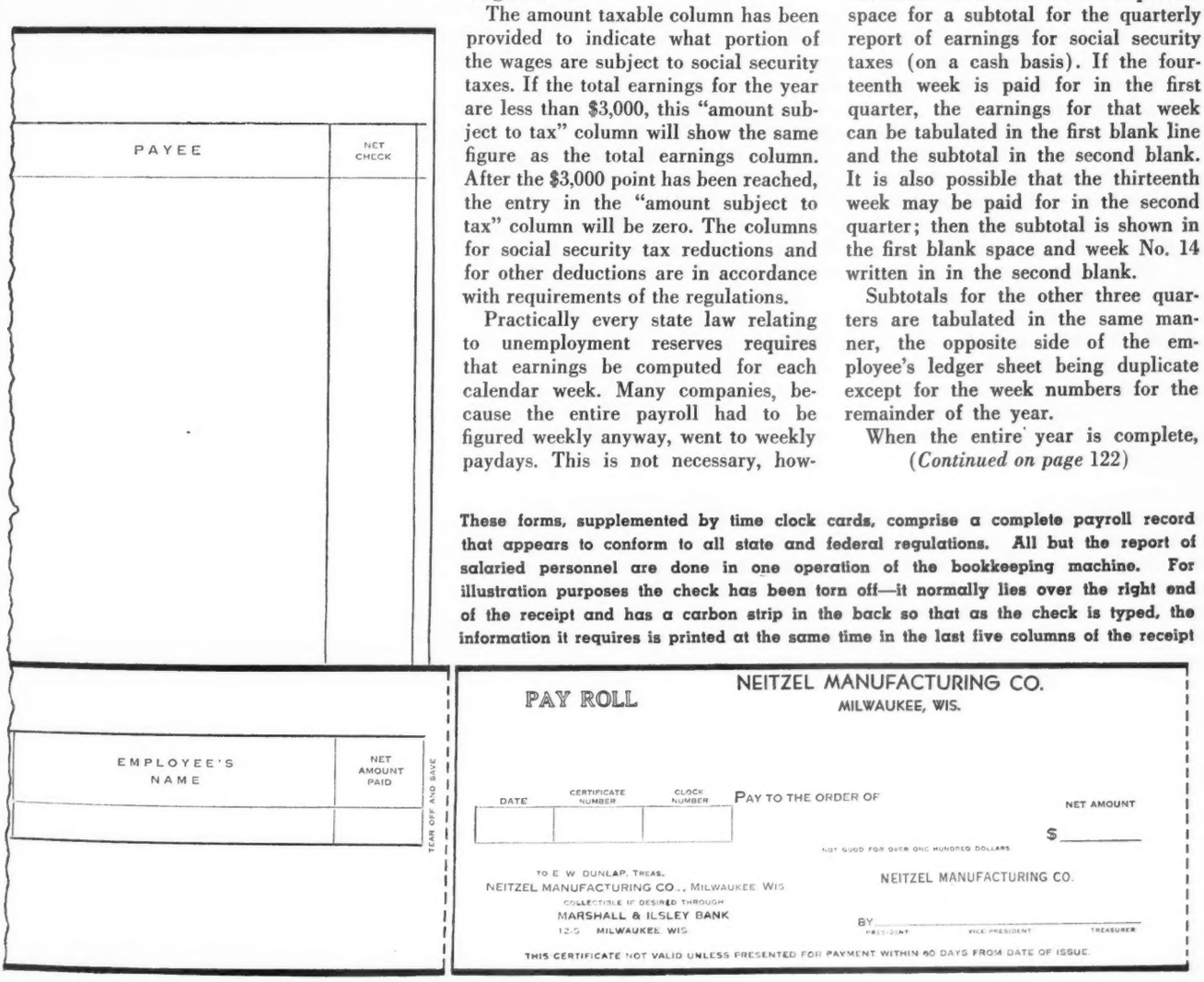
Unfortunately, the various laws affecting payroll records are not on the same accounting basis. For example, earnings of employees must be reported for federal social security taxes on a cash basis, but for internal revenue purposes at the end of the year the earnings must be on an accrual basis.

On the employee's ledger sheet two blank spaces have been left after the thirteenth week in order to provide space for a subtotal for the quarterly report of earnings for social security taxes (on a cash basis). If the fourteenth week is paid for in the first quarter, the earnings for that week can be tabulated in the first blank line and the subtotal in the second blank. It is also possible that the thirteenth week may be paid for in the second quarter; then the subtotal is shown in the first blank space and week No. 14 written in in the second blank.

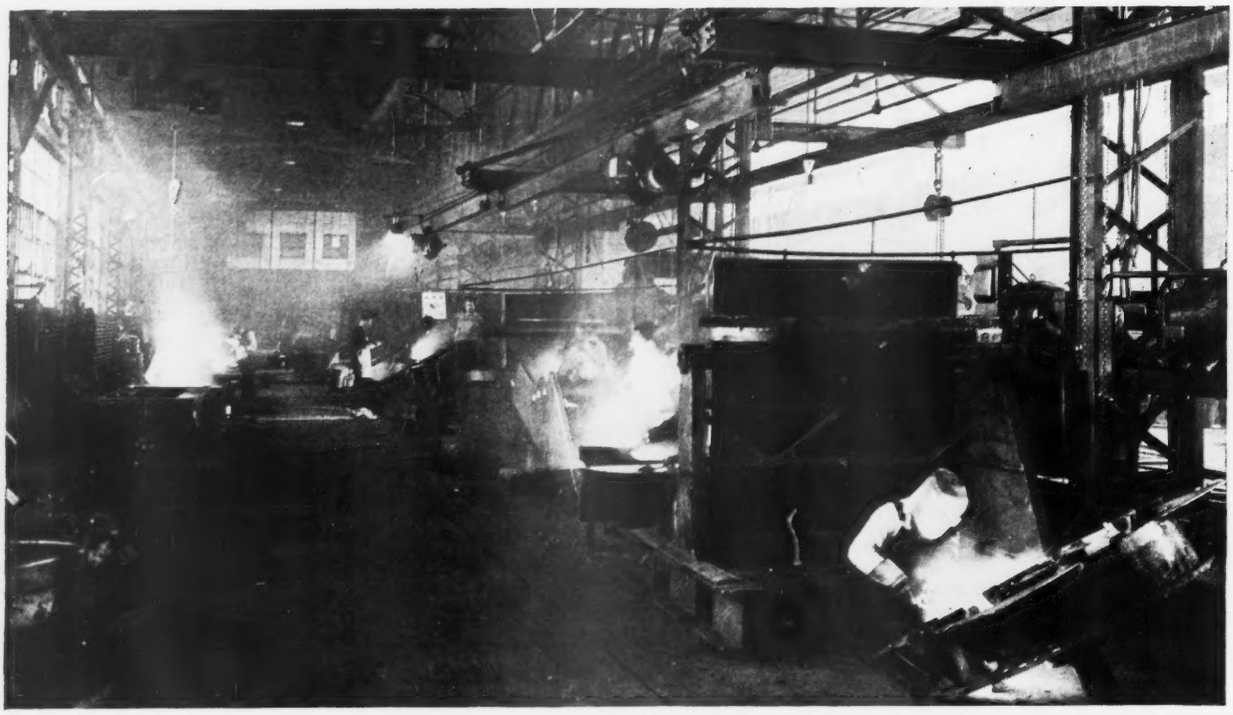
Subtotals for the other three quarters are tabulated in the same manner, the opposite side of the employee's ledger sheet being duplicate except for the week numbers for the remainder of the year.

When the entire year is complete,

(*Continued on page* 122)



These forms, supplemented by time clock cards, comprise a complete payroll record that appears to conform to all state and federal regulations. All but the report of salaried personnel are done in one operation of the bookkeeping machine. For illustration purposes the check has been torn off—it normally lies over the right end of the receipt and has a carbon strip in the back so that as the check is typed, the information it requires is printed at the same time in the last five columns of the receipt



Each welder has his own working area, serviced by hoist. For other, longer moves there is the floor-operated traveling crane

Organized for Welding

An outline, based on the Harnischfeger experience, for setting up a welding department. Organization, including attention to handling and salvage, is all-important

W. V. EMERY

Welding Inspector
Harnischfeger Corporation
Milwaukee

BUILDING UP a crew of skilled operators is not so important to the success of production welding operations as is thorough organization of the department. This we found when we set up a modern welding shop for the production of heavy machines.

This organization should have, first of all, a designer who is not only thoroughly competent in design, but who has also had enough practical experience to fabricate in such a manner that all welds are easily accessible. In doing so, he will use bent plates and standard shapes to a great extent, reducing weld footage to a minimum. All welds should be specified in detail on drawings using standard approved welding symbols. These welding symbols have been adopted by the American Welding Society with the idea of making a "welding language" for universal use. They are simple in the extreme and should be learned by everyone who deals with welded products. The care and thought put into their design were considerable and they will go a long way towards reducing errors in translating drawings.

Once design has been coordinated to shop facilities, the weldery or welding plant department resolves itself into the branches indicated in the chart. These branches include design, production welding, one-machine production welding, segregated parts division, sheet metal welding, salvage welding, and maintenance welding.

The first branch, production welding, is divided into several component parts —preparation, which consists of shearing, shaping, cutting, machining, and bending (or otherwise preparing for welding); set-up or assembly; actual welding and inspection.

All preparations should be under direct supervision of the welding department head for this reason: The usual structural or plate shop, in which riveting has been the standard construction, concentrates on hole centers and not on outside plate or shape dimensions. Thus, shearing that was exact enough for structural work is by no means accurate enough for welded products. Frequently a decision must be made as to whether shape cutting or shearing must be resorted to. In such cases the usual structural or plate-fabricating department invariably decides to shear on account of the apparent economy. It then finds itself confronted with higher welding costs due to poor fits caused by shearing inaccuracy and shear warpage. This is also often the cause of sloppy appearance in the finished product. In any case, the whole responsibility for accurate assembly and weld qualities should rest upon the welding supervisor.

In welding departments fabricating a varied assortment of welded pieces, it is economical to have exclusive set-

up men who need not be welders. In fact, the average welder should have, but usually does not have, the ability to read drawings and do set-up work correctly. It has been found that with a few hours instruction in making tack welds, structural layout men or templet makers make the best set-up men, and for very accurate work a machine layout man is preferable. This type of set-up organization does away with the more expensive practice of using a welder as a set-up man's helper.

It is wise, when you are breaking in one of these men, to place a welder with him for a few hours at the start in order to teach him how to tack—he quickly learns and is soon on his own. We have often assembled pieces weighing up to 15 tons, using only one set-up man and a jib crane over the set-up table to handle the parts.

In case the production is of many varied assemblies and is of sufficient quantity to maintain a crew of four or more set-up men, it is economical to inspect the assembling parts before welding, for machine allowances, location of pads, and accuracy of the dimensions. This inspection is usually done by the senior set-up man.

Each Set-Up Man a Specialist

It is also well to have each set-up man specialize on certain classes of work because then he knows the allowances that must be made for shrinkage and warpage in many assemblies. In the general welding department in our shops, for example, we have certain classes of work apportioned to each of the various set-up tables. We find that this practice reduces costs considerably, as articles fabricated for a certain purpose are of similar design regardless of size, and, in a complicated set-up, familiarity with the construction of the part to be fabricated has been found to promote efficiency and economy.

The same practice is also followed in allotting work to the various welders. Work that can be handled by one operator using a small hoist and a hand-operated manipulator, is routed to single booths which are so constructed with standard self-contained shields that fitting the booth to the work to be done is a small matter. Thus each single operator has a certain class of work to do with which he is thoroughly familiar. A storage space for work to be done is adjacent to each booth, and the parts are placed in the proper booths as they are taken from the set-up tables. For the welding of larger parts, usually two operators are needed.

After welding, all parts are thoroughly cleaned, chipped, peened, and ground where necessary. Parts that call for stress-relieving are also sand-blasted to remove the scale after heat-treatment. Also, the parts are inspected for weld imperfections, proper location of machined pads, checked for shrinkage and warpage. Each welder has a symbol stamp to place on his work so that any imperfection in his welds is directly traceable to him. These identified welds bring about a marked improvement in welding jobs.

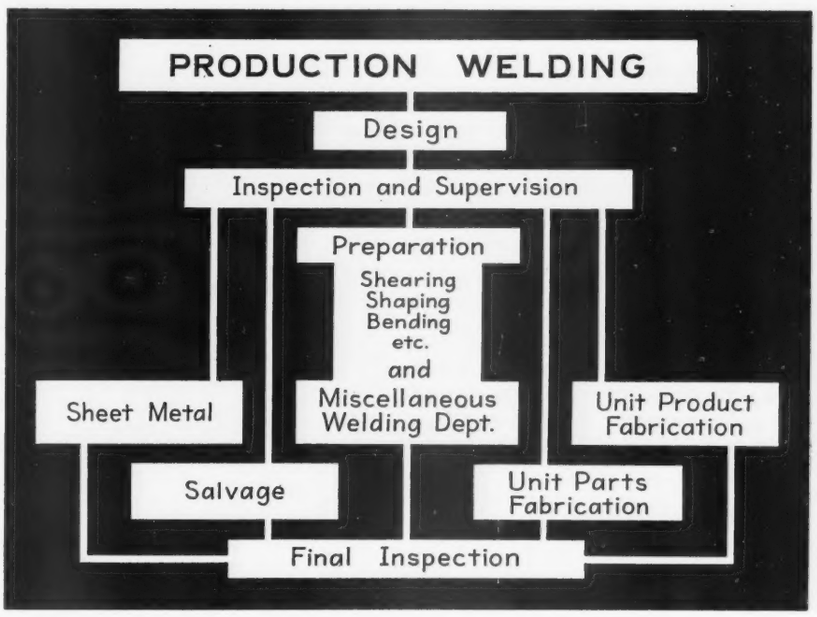
Welders, Too, Are Specialists

In some instances, if production warrants, it is advantageous to segregate the complete welding operation on one machine or model adjacent to the machining and assembly operation. When this is done, all the men in that particular crew become specialists on that assembly. As a result, costs are lower, weld qualities are improved, and special manipulating or positioning devices can be utilized to their best advantage. The cost of supervision is also reduced to a minimum, as working foremen can be placed in charge of these divisions. Chippers can be instructed to inspect for weld imperfections and further reduce inspection costs.

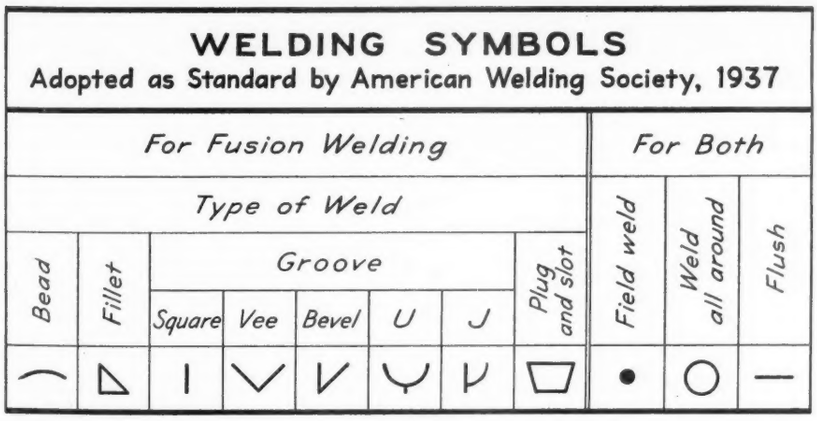
In the welding of parts used in quantities on a number of assemblies, especially those on which special procedure is involved, quality and economy may be obtained by the segregation of the welding operations into a fourth group. The welding of gears, dippers, dipper handles, and counterweight boxes are now so segregated in our shops.

Throughout the shop, as well as in this bay where the production of standard pieces is carried on, another im-

(*Continued on page* 126)



Organization chart for production welding shows segregation of welding activities



Designed to supply a universal welding language, these symbols are easily learned

Setting Time Standards When

Automatically recorded data on manually controlled machine jobs are basis of incentives that employees admit are fair, that save 5 per cent in excess labor costs

C. B. CARR

Industrial Engineer, Revere Copper & Brass, Incorporated
Rome, N. Y.

UNCONTROLLABLE VARIABLES that enter into the construction of time standards are so numerous that it had been common practice with us to average them into the time standard. When the range of the variable is small, this works out satisfactorily. But when workers are made to absorb wide variations over which they have no control, as in rolling or drawing metal, it becomes a source of discontent. On the other hand, when we set standards to protect the workers against loss, a survey showed that the company was taking a loss.

The solution, we found, lay in the use of machine-operation recorders. It is an excellent example of what can be done in the way of control—and it is a way that can be followed in any industry where machine time is an uncontrollable variable.

Pyramid to a Headache

Our business is that of rolling or drawing cakes or billets of non-ferrous metals into sheets, tubes, and rods. When a slab or billet of brass or copper is cast, castings from the same mold will vary in weight, because of shrinkage. This is the beginning of a series of variables which pyramid into a headache for those who must establish time standards and determine costs. When a casting has set and cooled, the shrink end is cut off. Sometimes it is necessary to remove far more than the amount allowed for gate, in order to get rid of this defective end and insure sound metal. Thus we add another weight variable.

Weight is an important factor in our process, because, as metal passes through successive stages of rolling or drawing, it lengthens in exact proportion to its weight. As rolling or drawing speeds are constant for a given gage or reduction, the result of variation in the bar weight is a variation in the machine time required for rolling or drawing. As the billet or bar progresses through the fabricating stages, breaks caused by mechanical injuries may occur, which make two bars or coils of metal out of what was one originally, and that original of questionable weight. As the metal is reduced to paper thinness in successive operations, other breaks may occur, which further complicate the task of establishing standards.

Originally we took care of these variations by weighing metal in process and establishing standards on a handling and poundage basis for each separate stage of reduction. This practice required the handling of metal many times during its processing, was expensive, and undesirable from the standpoints of materials handling, production flow, and computation of earnings. It was discarded in favor of averaged weights, with the averages established favorable to the operators. The use of averaged weights was not as expensive as the practice of determining actual weight, yet was responsible for a 5 per cent excess labor cost. At a time when our plants were crowded with production and the labor situation was delicate, we found the most satisfactory answer to the problem lay in the use of machine-operation recorders.

A total of 490 machine-time recorders are already in use in the Revere plants; they furnish indisputable records of manually controlled machine performance. This large recording room at the Rome Division is typical of several other Revere installations

We wanted to save the 5 per cent and at the same time devise an expedient that would make possible the payment of wages to operators in direct proportion to the amount of work they produced. Use of these electrically operated machine-operation recorders, combining strip and round-chart recorders in such a way as to provide both a chronological record of machining operation and totals of machine times, enabled us to do this. The charts obtained are accurate, permanent, visible records of man and machine performance, and not only furnish the production, industrial engineering, and cost departments with accurate data, but also form the nucleus of our in-

Machine Times Vary

centive plan for controlling direct and indirect labor costs. At the same time they provide fundamental information for our supervisory bonus plans.

It is as much to this recording apparatus, as to the skill of our engineers, that we credit the cooperation of our employees in the successful installation of a new wage incentive plan throughout our organization, an installation made during the unsettled conditions of the past three years, when many organizations found difficulty in following their wage plans.

Two Types of Recorders

The recorders we use are of conventional types, familiar to most plant operating men. We use a 20-pen strip recorder for the chronological record and the standard round-chart recorder as an accumulator of running time. The two are connected in parallel so that the latter runs only when the strip chart is recording activity of the machine it is connected to.

At this time a total of 490 recording units are in use throughout our company, furnishing indisputable records of manually controlled machine performance and providing records of an accuracy unobtainable through conventional production records.

Proof of Performance

An invaluable feature of the records is their use in cases of disputed earnings as proof of a man's performance. Employees recognize that this method of recording their performance is absolutely fair and impartial, and they have never disputed the recorded evidence. We have no tight standards, where men are forced to race through their operation at the sacrifice of quality. We have no loose standards which permit men to coast through their operations, because we pay for the exact amount of work done.

In application, a contact is arranged on the machine whose production is to be measured, in such manner that it closes while the machine operates and opens during the idle or interval period between operations. When the contact closes, the round-chart recorder or accumulator, located in the office remote from the mill, starts to operate. When the productive period has ended, this accumulator stops, and the interval or delay between operations is recorded on the strip chart, which is a chronological record of the entire day. One of the round charts is shown in Figure 1 and a section of a strip chart in Figure 2.

Through the use of a button, pressed by the operator at each change of job, the productive machine time for each job is indicated, and at the end of the day the total accumulated productive machine time is a matter of record, the space between transverse lines on the round chart being the elapsed machine time for that individual job and the final reading representing the total day's performance.

The contacts at the machines are of several types differing for each kind of machine. In some cases where idle machine load is small in comparison with the work load, a current coil and relay are used. In other cases the amount of stretch in a roll housing, caused by the pressure built up through metal passing through the rolls, is sufficient to operate a sensitive switch. In still other cases a centrifugal switch, operating through the change of speed of a moving shaft that slows down when work is done in the machine, is employed. In some instances a photoelectric cell is used.

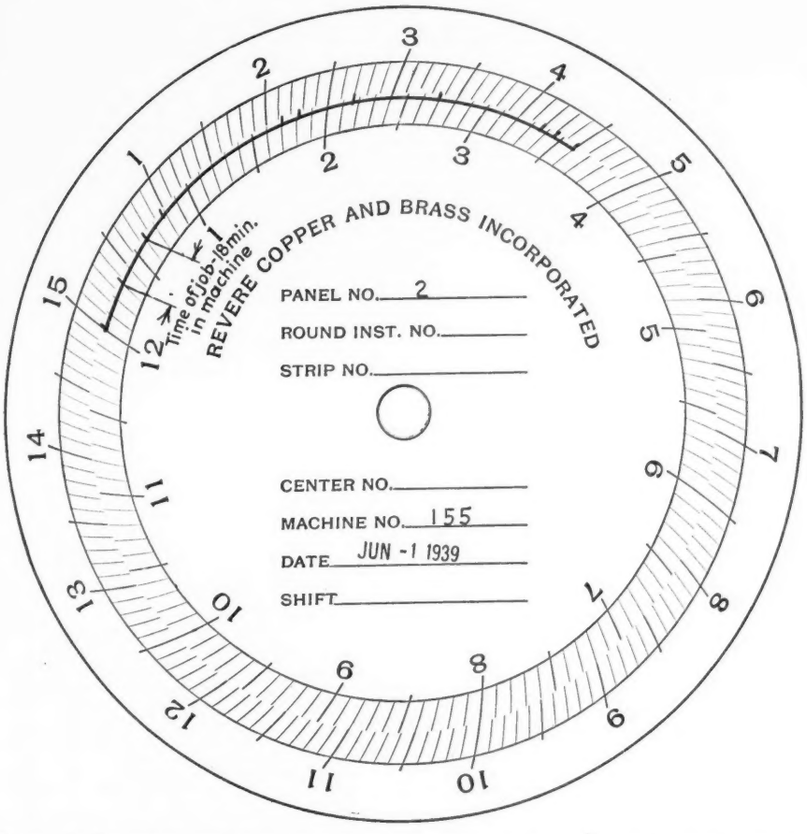


Figure 1. Operating time is accumulated on round-chart recorders. Space between transverse lines indicates time for job; length of recorded line represents day's total

Paid for What They Produce

These contacts at the machine are very important. They must be tamperproof, as any manipulation of them would cause a false recording. But it has been our experience that with a little study a completely satisfactory device can be worked out for practically any machine. At the instant work enters a roll, drawbench, or other productive unit, and the machine contact closes, a pilot light, integral with the recorder system but mounted so that it is visible to the machine operator, lights up and burns during the entire productive cycle. Our operators know that this pilot light is in series with the accumulator recorder and indicates to them that they are being paid for exactly what they produce,

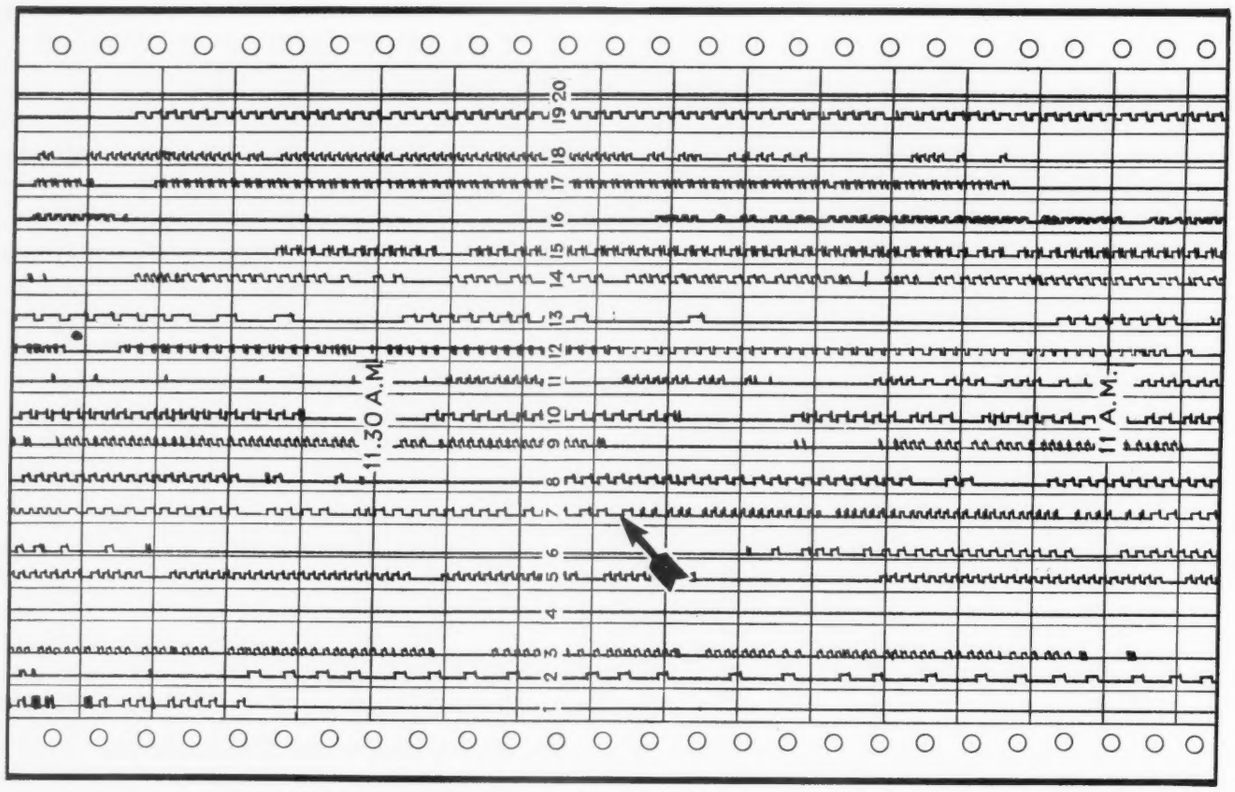


Figure 2. Strip chart shows number of pieces produced in a day and extent and time of delays. The 20 pens move slightly to the right when operations they are recording are running; long unbroken lines indicate down time. How irregular times for the same operation can be is best illustrated on machine No. 7's record—note the short regular sequences and the longer, delayed intervals

ending all argument or controversy over time standards for machine time. Standards for handling or interval, being uniform and easily checked by the operators, have not been controversial.

By referring to the chronological strip chart we are able to count the number of pieces produced and determine the extent and time of delays. The record for machine No. 7 on the chart shown in Figure 2 (see arrow) illustrates the difference in running time that may occur for bars in the same lot of work, and shows up the difficulties that would be encountered in trying to build up by more common methods a time standard to cover this machine time variation.

Paths for 20 Pens

Close scrutiny of any record in this group will disclose variation, though not so drastic as the No. 7 record. The chart is ruled with a path for each of 20 pens, and during productive time each pen moves slightly to the right. The long line on the left is made by the pen while the machine is idle, probably while die or gage changes are being made. Each of these periods is explained on the operator's daily time and production record, made at the machine in the mill. Each entry is checked against the strip chart for start, stop, and duration.

Time studies have established standards to cover the intervals between bars. By extending standard times for these intervals, plus legitimate delay time, plus productive machine time, we arrive at the day's earnings, without extensive calculation and with great accuracy. Incidentally, the strip chart serves as an excellent check on the time-study men, as it records intervals and running time. Knowing that this check is available, the time-study men can work with more freedom.

While our primary object in installing these recorders was to effect a control over machine time variables, another and equally valuable use has come to us—that is, the recording of actual delays to machine production. Ours might be described as continuous-process operation, as work flows through successive stages progressively, and delay at any one point in the production line frequently throws the entire line off. This, of course, is true of any highly mechanized process served by mechanical handling equipment, or where one or more units are dependent for their supply of product on any other single unit.

Through a daily analysis of the chronological strip-chart record, we provide the operating staff with a classified breakdown of delays. Under the incentive of a supervisory bonus, they have reduced these delays in some instances as much as 50 per cent.

Through an analysis of these records the cost department is able to differentiate more readily between profitable and unprofitable production items, and our cost reduction staff obtains information that guides their work of lowering costs or improving operating conditions. Every major production unit in our twelve mills is fitted with recorders which give us control over casting furnaces, extruders, piercers, reducers, drawbenches, rolls, bull blocks, straighteners, dryouts, slitters, shears, pointers, saws, and practically all other machine operations.

Maintenance Cost Negligible

This control does not directly cover purely manual operations or indirect labor, but these are in proportion to machine production and are tied in on a flexible budget basis, which keeps them balanced with production.

Maintenance expense on the recorders is negligible, and on the contactors moderate, consisting of an occasional adjustment, generally due to mechanical injury when a coil breaks.

THE ABCs of PERSONNEL

On ultimatum and utopia, on vitality, vocabulary, and voice. These alphabetic observations will conclude in January with W, X, Y, and Z

CHARLES S. STEVENSON

General Manager, Hall Brothers, Inc., Kansas City, Mo.

SKETCHES BY MATHILDE SCHULZ MUELLER

Ultimatum

Bob Leonard was a grizzled, old-school type of shop superintendent, still hearty, hale, and spirited, but a retirement ruling forced him to the sidelines. "Just one word to you, Frank," he told his successor, "Don't never issue none of them there ultimatums to employees like I've been readin' of nations handin' each other lately. I've had a lot of fist fights 'cause I laid down the law without thinkin' of the consequences. Getting tough only made it harder for me to back down. Don't think those folks down there aren't experts when it comes to knockin' chips off of shoulders." *It's natural for people to rebel against force and dictatorship* . . . in any studied personnel program, stress on the evil of such tendencies is mandatory.

Utopia

"Just before I hire a young man, I say to myself, 'Does this lad impress me as one who may some day be president of our company?'" commented a personnel manager. "Oh, I admit the odds of each new employee actually becoming president are decidedly against its happening, but that doesn't keep me from looking them over from that angle. My idea is to have every employee so capable that his future and ours are completely assured." That any such utopia will prevail in any organization will be recognized as almost impossible, but those concerned with leadership should not let that assumption keep them from the effort and satisfaction of trying to attain it.

Vitality

George Santayana, renowned American philosopher, has rambled at random over the world viewing the "why's and wherefore's" of mankind. Interesting to executive-minded persons is his observation: "*Vitality of any sort can blunder through many a predicament in which reason would despair.*" Whether he meant mental or physical vitality is of no consequence, as his philosophy is true in either event. How frequently do we see men succeeding when by all rules of precedent and opinion they should be failing . . . the world is familiar with industrial and business successes that are living symbols of the vitality of some one man. *Stay by your job!*

Vocabulary

Fifty university students, as they graduated from a school of business and finance in 1934, took a series of tests to determine the extent of their vocabularies, agreeing to report back in 1939 their status in business. Their old psychology teacher, who has just finished analyzing their answers reports: "Everyone who landed in the first ten of the vocabulary test five years ago is now an executive of some sort . . . not one man in the bottom twenty-five has become an executive." He immediately decided that *success is in relation to the size and extent of a man's vocabulary.* It is unlikely that his findings will be accepted as conclusive, but they are at least intriguing enough for consideration.

Voice

Recent episodes in the life of Andrew H. Brown of Amos and Andy fame, disclose him as studying voice culture . . . lucrative contracts go to radio announcers who have warm, human, thrilling voices . . . William Jennings Bryan swayed millions by the ardor, sincerity, and enthusiasm of his delivery. A sales manager for a national organization claims that a person's voice is an indication to many characteristics. "It can show eagerness, enthusiasm, dullness, cynicism, impatience, insincerity, friendliness, antagonism, and other traits of which we should have knowledge." He says that whether they know it or not superiors in *any* field are using this same basis in forming opinions of folks under them, so . . . *watch your voice.*

Budgeting Inventories and

Vitally important to any business are its policies for smoothing out employment curves, thus providing its employees with the security of steady incomes. But employment can only be steady when production moves along at an even pace, and, as the authors point out, one factor that has a lot to do with whether production fluctuates or not, is inventories. Let raw material inventories get too low, and production waits for materials. Let finished goods pile up, and production must wait for sales to catch up. The authors believe that the answer to both the financial and social aspects of this problem can be found in a well-organized, well-planned, and well-controlled inventory turnover. Budgetary control is the means of carrying out this policy, and may therefore be a cogent expression of a company's industrial relations policies

P. K. POULTON and P. H. GOLDSMITH
Secretary & Treasurer and Budget Director
Talon, Incorporated, Meadville, Pa.

THERE IS PROBABLY not a reader of FACTORY, and of this article, who is not convinced of the necessity for unceasing vigilance and control over inventory investments. Many of us have learned this lesson through sad experience; others accept it as a simple statement of fact by which to guide their operations; but in no case can a business be long successful without management's active and constant attention to its inventory problem.

Inventories are storage reservoirs of the productive efforts of industry. They furnish the buffer that prevents large variations in sales demand from disrupting production schedules and employment. Inadequate inventories result in wide fluctuations in factory output with consequent increased costs and labor discontent, whereas excessive and poorly planned inventories bring about idle capital, together with increased investment, storage, and obsolescence charges.

It is particularly important that full cognizance be taken of the inventory obsolescence hazard. The market for almost every producer is subject to the risks of changing products, style variations, substitution of new products and price reduction by competitors—any one of which can bring chaos into an otherwise orderly inventory picture. Industrial history is dotted with stories of companies that failed because of mismanagement of inventories through lack of understanding the potential hazards involved. It is, therefore, easily understandable why it has become axiomatic that proper inventory balance, perspective, and control must be obtained if a manufacturing concern is to continue to operate successfully.

The established inventory policy of most companies is the result of a compromise between the conflicting and competing desires of different sections of the organization. The sales division is usually interested in seeing finished stocks maintained at a high level, so that there is no possibility of ever running short of stock items. The manufacturing division likewise wishes to be fully protected, in the form of both adequate finished stocks and raw materials as well as sustained employment. Moreover, it usually favors producing orders in large lots to reduce operating costs. At the other extreme stands the financial division, normally endeavoring to reduce stagnant capital and inventory costs as far as possible while still continuing to render completely satisfactory customer service.

Normal Industrial Policy

Somewhere between these opposing forces a compromise is usually drawn. Although changing market and labor conditions may dictate overnight revisions, the normal industrial policy is to operate with as high an inventory turnover as is consistent with good customer service and adequate raw material protection.

In initiating budgetary methods it is recommended that past inventory conditions be studied. This often reveals lax control methods. The downward trend of inventory turnover on the chart is such an indication. Incidentally, inventory turnover provides a most effective control factor for it is readily determined and easily understood.

It is extremely easy for a company to find its inventories increasing at a greater rate than sales. This condition is also illustrated by the chart. Continuation of the early inventory trend would have resulted in excessively large amounts of capital invested in stocks. The crosshatched area indicates the reduction in inventory which, in theory, should have been brought about by the installation of an inventory budget.

Both annual and monthly inventory budgets can be constructed for the coming year from the basic sales and production budget data, and a knowledge of the desired turnover. Figures 1 and 2 show such budgets, including figures for net sales income, cost of

Previous articles in this issue:
Budgeting for Profit (Sept., p. 52)
Budgeting to Cut Unit Costs (Oct., p. 48)

Stabilizing Employment

sales, inventory value, inventory increase or decrease, and turnover.

It is not enough, however, to establish budgets on over-all inventory alone. For proper control it is necessary to break each type of inventory—raw materials, work in process, and finished goods—down into component elements and establish a turnover budget for each. By so doing it is possible to determine just what portions of the inventory are responsible for unfavorable conditions in the organization's over-all turnover picture.

The extent to which control should be carried out on the individual elements depends upon the amount used, degree of standardization, and the annual value of the product concerned.

The raw-materials inventory should obviously be broken down by type into major materials that are used on either stock or special items. Figure 3 illustrates a breakdown of this type, which is prepared on a monthly basis. Thus raw-materials inventory may have an over-all turnover of 7.7 for the month, with the six or seven items composing it ranging from 11.2 to 4.5. Those materials with a low or below-normal rate of turnover are immediately brought to management's attention before they can seriously endanger the standing of the group, and possible savings are suggested in others.

Finished-goods inventory should have

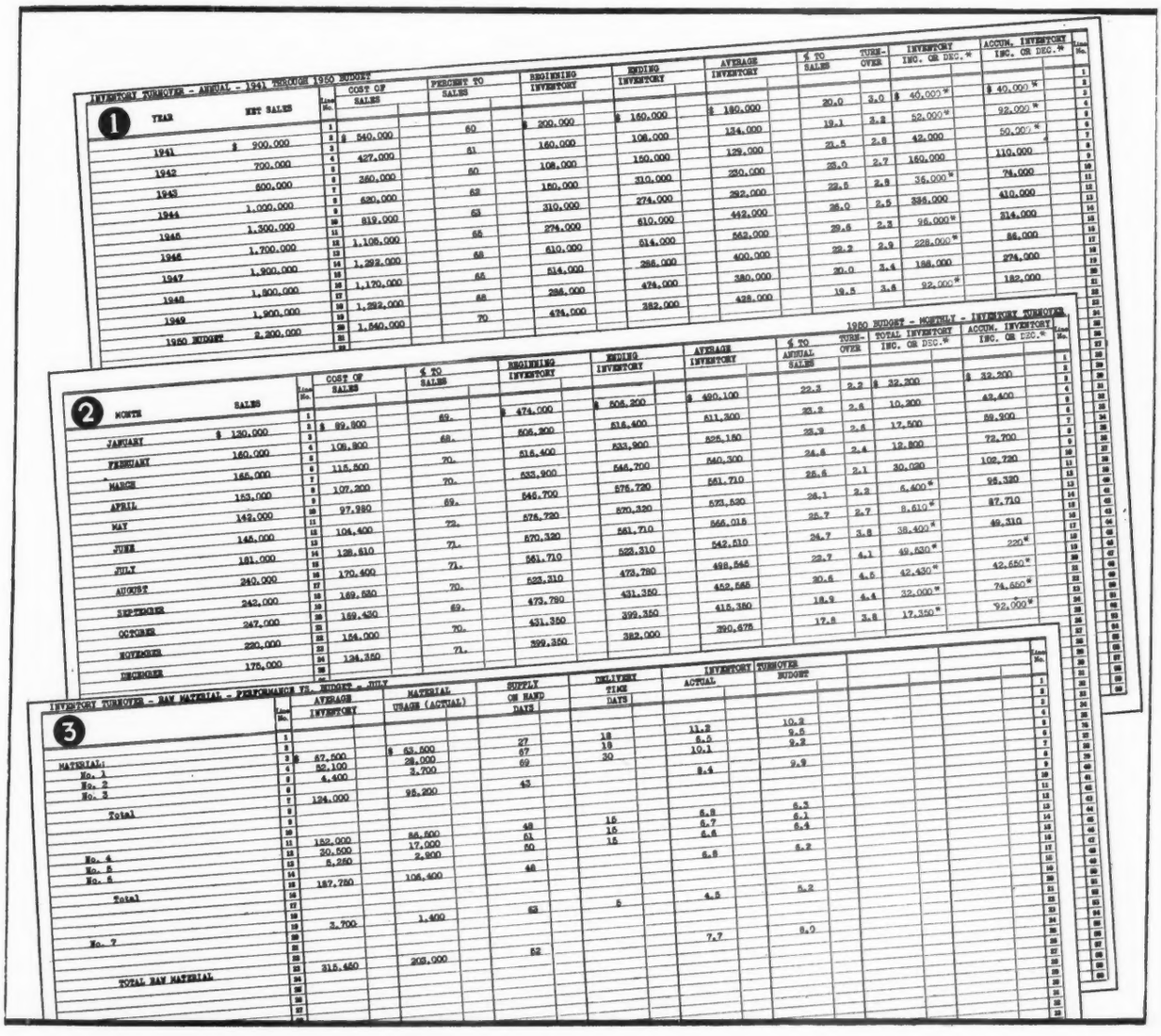


Figure 1. Knowing what inventory turnover is desirable, budgets for ten years ahead can be planned to determine what figures for sales and inventory should be aimed at. Figure 2. A monthly budget for ten years ahead, based on desired inventory turnover. Figure 3. Breakdown of raw material budget by types of major materials is made on a monthly basis. This brings to light classes of materials whose turnover is below average, and which therefore require special attention so that rate of turnover can be speeded up. Asterisks in the last two columns of Figures 1 and 2 indicate decreases which, actually, are always entered in red

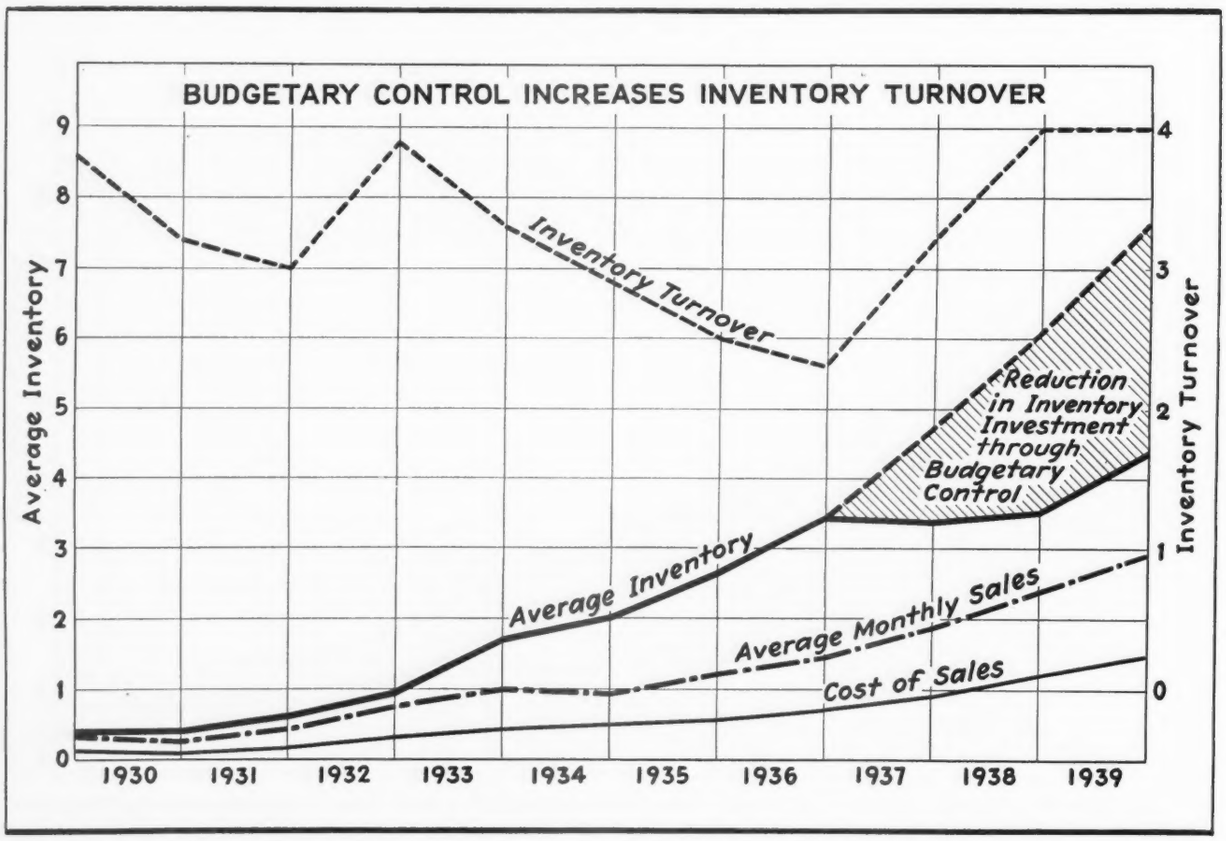


Chart for 10-year period gives the inventory picture in its relation to sales. It can be seen that inventory went down, inventory turnover up, when budgetary control was introduced. All the figures in this chart and the forms illustrated are hypothetical

individual turnover budgets established for all standard stock products having any appreciable volume. In addition, a separate turnover budget should cover the combined stock items of minor sales volume. This will permit close inventory control over the majority of products sold as well as the minor items in which inventories are so often allowed to build up to excessive quantities. Provision should be made for ready analysis of inventories in any stock item in case the turnover becomes too low.

Work-in-process inventory controls are usually best established in accordance with the stock points within the plant. In inventories of factory and office supplies, the mass of detail is usually so great that it is not feasible from a clerical standpoint to do more than construct an over-all budget and turnover control.

It is not possible to set any fixed ratio that inventory should bear to sales or cost of sales; the ratio varies both among industries and among individual companies within an industry, depending on type of product, characteristics of demand, availability of capital, plant investments, and planning methods. However, it is possible for any company to gage its performance in this respect by referring to tables prepared by Dun & Bradstreet and others, which indicate the high and low ranges of this ratio for different lines of business activity. The one general principle applying in such an analysis is that the ratio of inventory to sales is directly related to the demand stability of the product (excluding perishable articles, such as food produce).

Although approximations of the desirable over-all turnover may be obtained in this manner, an accurate knowledge of the inventory prospects of the individual concern can be determined only by making a careful survey of its own individual requirements and peculiarities. This involves a study of such factors as sales of stock and non-stock items by months and by key customers, production time cycles, material requirements, raw material delivery times, and stock minimums. The results of such a study should give a clear knowledge of the minimum and maximum stock requirements in each inventory element and the maximum turnover that can be expected.

It is too much to expect that any organization can be geared immediately to operate with the potential maximum turnover. Hence this ultimate attainment should be approached over a period of several years.

The importance of standardization cannot be overemphasized as a means of reducing both the amount of inventory necessary and manufacturing costs. To many concerns who produce mainly on a specification basis, standardization of finished stock may not be possible. However, while the finished product may be unique, the materials used may themselves be made more uniform or interchangeable, which may shift the inventory points or reduce the amount of inventory investment required.

If the number of basic raw materials can be decreased, it is self-evident that a higher rate of turnover will accompany a lesser investment, with a more effective use of capital resulting. Likewise, if greater emphasis is placed on the interchangeability of parts, and a larger percentage of inventory is put into work in process at that stage of development where it can be diverted into any of several channels of finished goods, there is less risk of a frozen inventory asset.

It is important that the fundamental budget principle of definition of responsibility be carried out in the formulation of inventory budgets. One individual

should be responsible for the control of each inventory element for which a budget is established. This is a matter that has received too little consideration in many organizations. Responsibility for inventories has not been identified with individuals. Failure to recognize this concept has often been a major factor contributing to inventory losses. It is just as important to make this assignment as it is to define responsibility for expenditure.

The course of events during the past ten years has made the public increasingly conscious of the vastness and complexity of the national labor problem and the need of some satisfactory solution to prevent maladjustments. Coupled with the increasing trend toward governmental planning and regulation of industry, it is evident that management must face the fact that industry, for its own future well-being, cannot avoid the fulfillment of certain broad social obligations.

A Cause of Discontent

One of the major underlying causes of present instability of employee income is the close conformation between production output and seasonal sales demands. Where production schedules are closely aligned with current sales, it is clear that wide variations in demand will be reflected in corresponding variations in factory employment.

One obvious step that can be taken by industry to relieve the employee of much of this seasonal instability of income, is to budget production and employment on a uniform basis and let variations in sales demand be absorbed by inventories. This policy may not be feasible in some industries because of nature of the product. There are, however, many manufacturing enterprises in which output could readily be budgeted to provide not only the much sought "straight-line production," but also "straight-line employment" over periods of six months or more.

What many managements fail to realize is that *a program of straight-line employment is usually accompanied by operating economies which make it more than self-sustaining.* The tangible economic benefits to be derived from such a policy fall in several categories, the most important of which are the following:

1. Maintenance of uniform production is conducive to a general increase in plant efficiency, and results in minimum unit costs of manufacture and improved quality of product.

2. The cost of hiring and training labor is reduced to a minimum. Employees hired and trained at considerable expense during expansion periods are the first to be released during succeeding periods of output contraction. The cost of this training becomes almost a total loss to the company, as only a small percentage of such labor is normally rehired for the same job.

3. Indirect labor cost elements are minimized. These include such overhead items as overtime, machine-downtime payments, the difference between the actual earnings of "green" labor and the guaranteed base rate, and idle time spent in waiting for work.

4. Scrap and waste of material and supplies are reduced. Seasoned operators contribute much to this savings. Moreover, under rapidly expanding schedules the demand is always to "turn out the product regardless of waste and cost." Any reader familiar with factory operations under such conditions will readily appreciate what can be done in the way of economizing on material through the proper planning and stabilizing of production.

5. Improved utilization of plant and equipment facilities is an important advantage of a straight-line employment policy. When it is necessary to provide production capacity to handle sales peaks amounting to two or three times the average demand, inefficient and costly utilization of capital invested in fixed assets occurs.

Obsolescence of existing facilities is always a factor that must be taken into consideration when making a decision as to whether new methods or new equipment will be installed. Therefore, the closer expansion programs are held to the anticipated *average* output requirements rather than peak requirements, the less will such obsolescence act as a deterrent.

Most of the above advantages represent tangible savings which are subject to approximate evaluation. Equally important are the *intangible benefits* such as: (a) Increased over-all operating efficiency; (b) improved quality; (c) increased skill of employees; (d) stabilizing effect upon the community; (e) labor contentment, with consequent reduction of labor trouble; (f) increased prestige resulting from company policy.

Will Pay Its Way

Such a program involves increased inventories at certain seasons of each year. In actual practice it will be found that with the long-range planning and close inventory control required, little or no increase in average inventories will take place. In fact, an increased inventory turnover will result. In this respect it should be noted that actual average inventories are likely to be high when hand-to-mouth production scheduling is employed. Lax inventory control and over-optimism often cause production to lag behind sales. Thus sharp decreases in sales result in piling up excessive stocks before peak production is reduced.

Straight-line employment is a policy that can and should be adopted by many industrial concerns. In most cases it will more than pay its own way through tangible reduction of operating costs. What is more important is that it will minimize one of the major causes of labor unrest.

If the industrial manager is alert to the merits of adequate inventory and straight-line-employment policies, and uses his budget program to facilitate their establishment and control, he will have gone far towards insuring the permanent success of his enterprise.

January FACTORY Gives You

INDUSTRY'S OPINION OF THE LABOR BOARD

Last January *Factory* gave you management's opinion of the *Labor Law*. This January *Factory* will tell you exactly how management feels about the Labor Board. Again copies of the survey will go to members of Congress, public officials and the press.

•

Read this frank report in the January issue

Motion Study Research

4(b). A Study of Simultaneous, Symmetrical Hand Motions

With both terminal points and paths of motion fixed, times for fundamental hand motions are found to differ from those obtained when terminal points alone were fixed

RALPH M. BARNES and MARVIN E. MUNDEL

Professor of Industrial Engineering and Research Assistant in Mechanical Engineering
University of Iowa

PART B OF THIS RESEARCH was undertaken to evaluate the effect of the angle which the motion paths of the operator's hands make with the plane of the front of the worker's body upon the efficiency with which the worker moves his hands away from and toward the body in a simultaneous, symmetrical fashion, *where both the terminal points of the motions and the path of the motions were fixed by the workplace.* Motions such as these are made by operators moving levers on machines. *Part A*, where only the terminal points of the motions were fixed by the workplace, was presented in August.

Equipment Used—In studying the motions where both the terminal points and the paths of the hands were fixed, the operator was seated in the same position in front of a table of exactly the same height as the table used in *Part A* of this study. The motions consisted of pushing carriages back and forth with both hands, along fixed slides, with fixed stops so located on the slides that the hands terminated their motions in the same positions relative to the body of the worker as they did with the "pursuit board" described in *Part A*. The two hands moved the carriages back and forth simultaneously and in a symmetrical fashion. Data were taken with the terminal points in the same positions as before; that is, in positions of 90, 60, 30, and 0 degrees.

Working on the Slides

Figure 1 shows the operator working on the slides where each motion path makes an angle of 60 degrees with the plane of the front of the operator's body. At each end of each slide there was a copper contact that was closed when the carriage came in contact with the stop. Through the electrical connections shown in Figure 2, these contacts served to actuate solenoid-operated pencils marking lines on a strip of paper moving at uniform velocity through an electrical recording kymograph. Whenever one of the contacts at either end of a slide was closed by the movement of the carriage, the solenoid-operated pencil to which it was connected made a jog on the moving strip of paper passing through the electrical recording kymograph.

Figure 1. Arrangement of the workplace when both the terminal points and paths of motion were fixed by slides. Only one arrangement is shown—the motion path of each hand makes an angle of 60 degrees with the plane of the front of the operator's body

Figure 3 is a reproduction of one cycle of the record taken on the moving strip of paper. Line *A* represents movement of the contact on the left-hand slide which was closed when the carriage was at its nearest position to the operator. The first jog in line *A* was made by the carriage closing the contact. When the carriage was pushed to its other extreme position on the slide, it closed the other contact, thus making the first jog on line *C* of the record. Other jogs were made as the carriage reached any extreme position. Line *B* shows opening and closing of both contacts on the right-hand slide.

The distance *T* represents one complete cycle of motions. This is the sum of the time required for the initial "change direction" preparatory to the first *transport loaded* or movement away from the operator, the time for the actual movement, the subsequent "change direction" at the other end of the slide, and the second *transport loaded* or movement toward the operator, which completed the cycle. The distance that each of the carriages had to be moved for each *transport loaded* was ten inches.

The apparatus used in this part of the study will be referred to simply as "the slides."

Procedure—Within a day or two after an operator had finished the twelve work spells at the pursuit board described in *Part A*, data were taken of this worker operating the slides. Since the operator had had considerable training at making simultaneous,

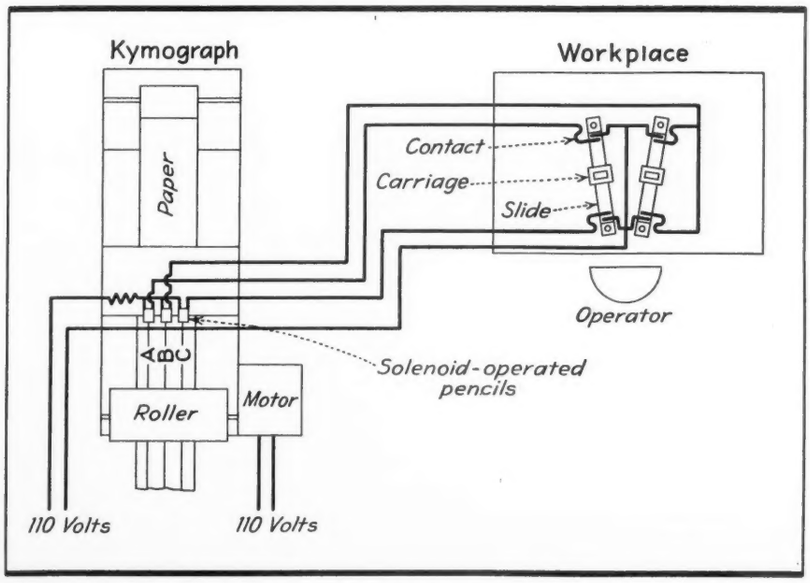


Figure 2. Wiring diagram of the slides and auxiliary equipment used in this study

symmetrical motions at the various angles, and had performed 3,600 cycles of motion at each of the various angles, and since the angles of the motions made on the slides were the same as those on the pursuit board, it was not deemed necessary to give the operator much additional training. Therefore, the operator being tested was allowed to practice moving the carriages back and forth for one minute at each of the four angles or tasks.

As Fast as He Could

Following this practice period, the operator practiced for one-half minute pushing the carriages back and forth at the 90-deg. position as fast as he could, and the data for the next ten cycles were recorded. In like manner data were taken at 60, 30, 0 degrees; again at 0, 30, 60, and 90 degrees; all in that order.

Throughout this part of the study the operators worked at their maximum rate so as to provide a single level of effort at which comparisons could be made of the relative amount of time required for cycles of motion at the different angles. A large amount of time for a cycle under a given set of conditions indicates a low rate of production, and conversely, a small time per cycle indicates a high rate of production. It will be noted that an increase in the time per cycle indicates a falling off of production as does an increase in the number of cycles missed, which was the criterion in *Part A*. To insure uniformity, the same ten operators who worked at the pursuit board in *Part A* were studied in this second part of the investigation.

Results—The time required for each of five consecutive cycles from each of the two runs at each of the four arrangements of the workplace for each of the ten operators, was determined.

The result sheet gives the average time required by each operator at each of the four different arrangements of the workplace, the total group average, the average of the fastest four operators, and the average of the slowest six operators. The results have been split in this fashion because the faster operators displayed distinctly different trends than the slower operators, and this split gave two more homogeneous groups.

The individual averages, the total group average, the fastest four operators' group average, and the slowest six operators' group average are presented graphically in Figure 4.

Two Distinct Groups

Conclusions—These conclusions apply to the operators studied in this experiment and for 10-in. movements made simultaneously and symmetrically under the working conditions of this specific study.

1. The operators, in general, were able to perform a complete cycle of motions most rapidly when the paths of the hands each made an angle of 60 degrees with the plane of the front of the operator's body. Motions where the aforementioned angle was 90 degrees required 5 per cent more time; where the angle was 30 degrees, 3 per cent more time; and where the angle was 0 degrees, 9 per cent more time.

2. The operators studied could be divided into two distinct groups, the fastest four making their fastest cycle when the paths of motion made an angle of 0 degrees with the plane of the front of their bodies, the 90-deg. motions requiring 9 per cent more time, the 60-deg. motions 5 per cent more time, and the 30-deg. motions 8 per cent more time. The slower group displayed the general group trend with the

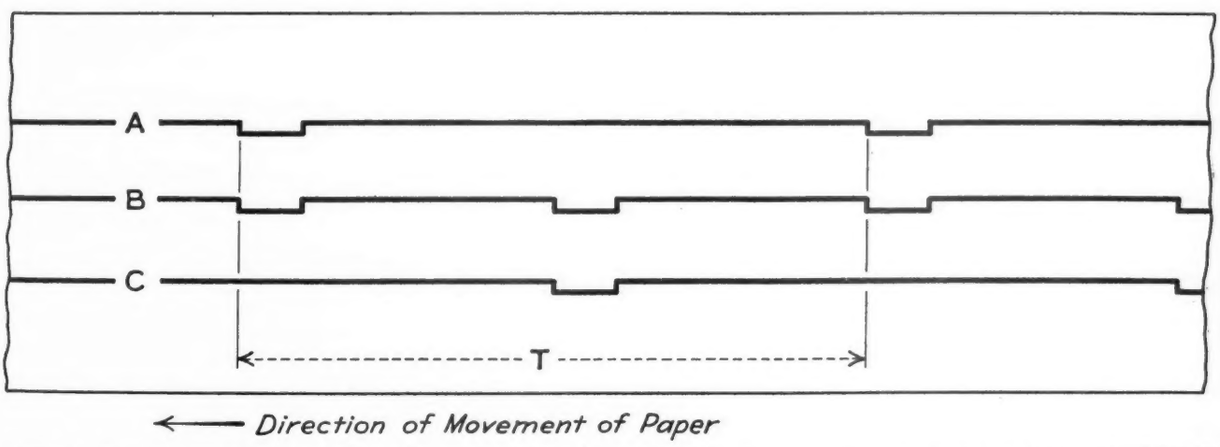


Figure 3. The kymograph record. When slides reach limits of their travel, jogs are made in the lines on the record. Lines *A* and *C* show closing of contacts on the left-hand slide; line *B*, both contacts on right-hand slide. *T* represents one cycle of motions

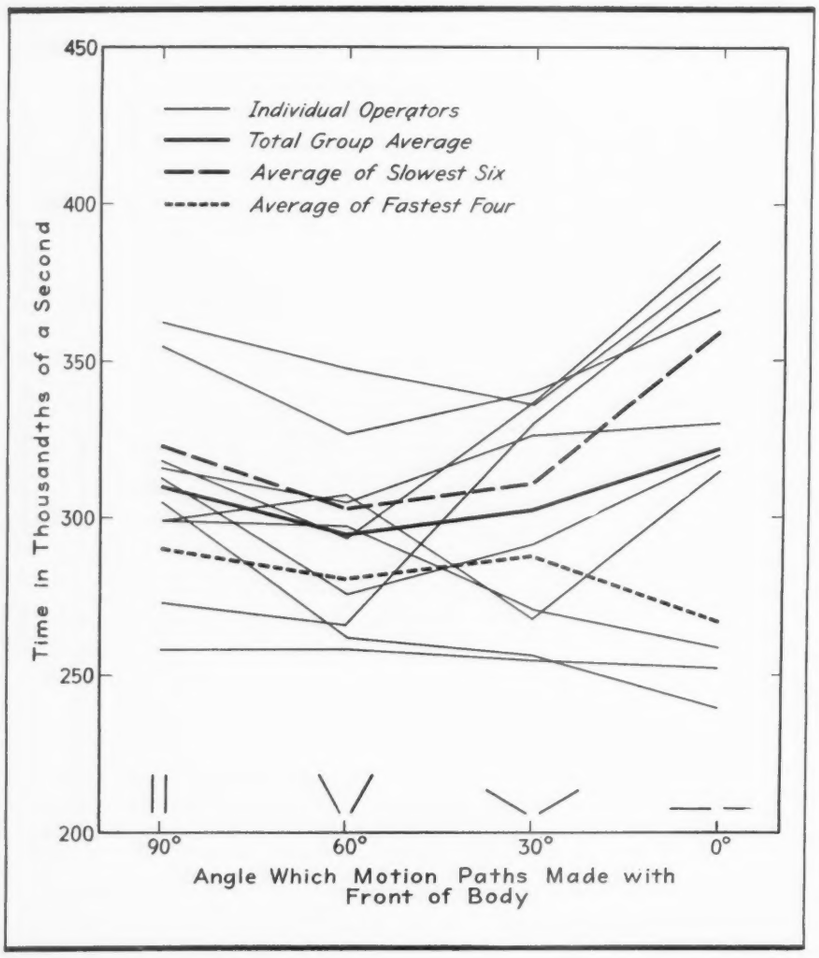


Figure 4. Graph of the average times of individuals, the whole group, and of the slowest and fastest sections of the group

exception that the 0-deg. motions were unusually slow.

It is to be noted that the fastest operators made their second fastest cycle when the paths of the hands each made an angle of 60 degrees with the plane of the front of their bodies. In both cases, however, the results are distinctly different from the results obtained when only the terminal points of the motions were fixed, as in *Part A*.

Making a 60-Deg. Angle

3. The foregoing conclusions suggest that simultaneous symmetrical motions of the hands, with both the terminal points and the paths of the hands fixed by the workplace, are distinctly different from motions where the operator must *direct* his hands toward a fixed terminal point. In general, where both terminal points and paths of the hands are fixed, motions should be made in such a way that the paths of the hands each make an angle of 60 degrees with the plane of the front of the operator's body. However, fast operators are able to make the motions most rapidly when the angle is 0 degrees; that is, when the hands move parallel to the front of the operator's body.

It is suggested that when the slides are used no visual direction is required to perform the motions, and the optimum conditions are primarily determined by the arm muscles of the operator. With the pursuit board, on the other hand, the operators had to locate the terminal points visually each time they moved their hands. It is suggested that with the pursuit board and the 90-deg. arrangement, the greater ease and less fatigue occasioned in visually determining the location of the two most distant terminal points far outweighed the possible greater muscular ease of the other angles.

Eye-Hand Coordination

Since most industrial tasks involve hand motions that have only their terminal points fixed by the workplace, and the operator must visually locate these places, and since the ease of seeing these points may be a more important factor than muscular ease, it is suggested that the eye movements required in an industrial task be given great consideration. At least, the eye-hand coordination requirements should be carefully studied so that optimum conditions are provided for them.

RESULT SHEET
Both terminal points and paths of motion fixed

Average time required by each operator to perform one cycle of motions, total group average, average of four fastest operators, average of six slowest operators. Time in thousandths of a second.

Operator's Number	*Operator's Rank in Speed**	*Angle in Degrees Which Path of Each Hand Made With the Plane of the Front of the Operator's Body*			
		90	*60*	*30*	*0*
1	1	258.3	258.6	255.2	252.7
2	4	299.1	307.2	268.4	315.5
3	5	313.1	276.7	292.4	320.4
4	7	316.1	305.1	326.7	330.4
5	9	355.1	327.9	340.4	366.9
6	6	273.0	266.3	331.6	377.8
7	3	299.2	297.1	271.4	259.5
8	8	318.5	293.7	337.2	389.8
9	2	305.2	262.3	256.5	239.7
10	10	361.9	347.6	336.6	371.7
Total group average		310	294	302	322
Per cent of minimum		105	100	103	109
Group average for four fastest operators		290	281	288	267
Per cent of minimum		109	105	108	100
Group average for six slowest operators		323	303	311	360
Per cent of minimum		107	100	103	119

* On the basis of the average time required at the four different arrangements.

Management Shorts

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

HANDLING, LAYOUT, MOTION ECONOMY

Photographic Plant Layout for the Production Office

ROBERT A. TRUMPIS
General Superintendent, Universal Form Clamp Company, Chicago

If you are proud of your shop, it is only natural that you will try to point out its high lights to people who come to your office, and describe the different production set-ups, your pet machine layouts. One thing leading to another, you will probably end up by making a tour of the plant.

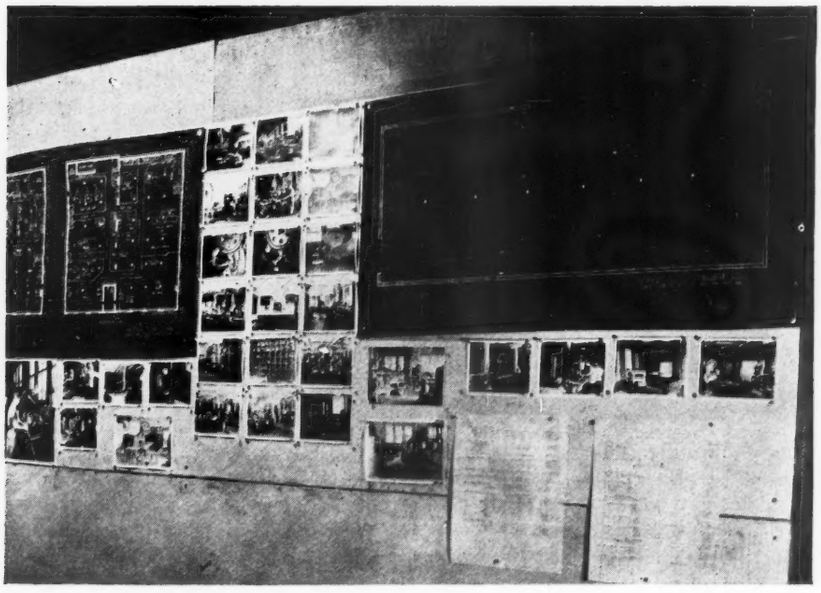
We are human enough at our plant to be proud of our shop. We like to discuss our set-up, our production methods, and layout with visiting plant men, sales engineers, and our own executives. Invariably, questions are asked that can best be answered by looking at the machine or department in question. However, too many such inspections forced us to reverse the procedure and take a step that, in effect, brings the plant to the office.

Against one wall of the plant waiting room we erected a sheet of lacquered plywood 4 x 8 feet in size. Against this background we mounted blueprints of the plant layout. Then the entire plant was carefully studied, and 27 five-by-seven photographs were taken as representative coverage of the entire shop.

To tie the pictures in with the plant layout blueprints, the photographs were mounted next to the blueprints approximately adjacent to departments in which they were taken. They were identified with colored numbered pins which corresponded in number and color to the pins in the layout.

Additional descriptive legend was attached to one end of the layout board so that each photograph could be readily understood. This descriptive chart was made out in approximately the following detail: Name of department, location of department, most important items made in the department, number of pieces of equipment in the department, name of the piece or section of the equipment or department shown in the photograph, and any interesting detail relating to the department or equipment.

This photographic plant layout has been successful in giving ample visual description of departments and equipment so that points in question can be settled without visiting the shop.



Photographs are mounted on the layout next to departments in which they were taken

•

Inspect wire rope sheaves periodically to make sure that they are smooth and that their grooves are slightly larger than the rope. Corrugated or pinching sheaves cut rope life.

•

Motion Economy on Labeling Operations

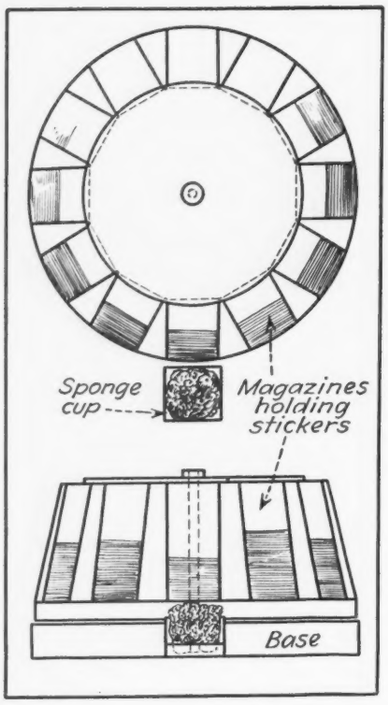
C. A. BARNES, *Minneapolis*

Nearly every factory uses gummed stickers somewhere along the packaging line. Since the job does not require the services of a large number of people, or involve intricate machinery, most plants are satisfied to allow operators to stand day after day hunting out stickers, separating those that are stuck together, and moving the hand several inches out of the way in order to contact the sponge that is being constantly used to moisten each label.

Time on this simple operation easily can be saved by:

1. Having the manufacturer of the stickers powder them slightly so that they do not stick together.

2. Having a holder built for the stickers. I have found that if the holder is about 3 inches high, built on a slight slant, and open in front, that the operator can, with the first finger and thumb, secure one label at a time without hesitating. If the operator needs



an assortment of sized stickers, as in a hosiery labeling operation, a number of these magazines can be mounted on a rotary holder.

3. Placing the sponge cup directly in front of the sticker magazine.

Packagers of confectionery and hosiery, and other large consumers of sticker seals, will find that the above methods will increase output 30 to 50 per cent on this particular job.

•

Color Photography for Motion Studies

H. L. MANNING, *Department of Industrial Engineering, Sibley School of Mechanical Engineering, Cornell University, Ithaca, N. Y.*

For a number of years the industrial engineer has used motion pictures as a research tool in job standardization work. Now we believe we have a further improvement—the use of color.

Recently color film for inside photography has been made sensitive enough to be practical for the semi-amateur, or even the amateur. The added cost of color film of the same relative sensitivity as the usual black and white is small—less than two cents a foot. There are, we have discovered, many advantages to photographing in natural color, which make the slight added cost worth while.

In our micro-motion laboratory we have a supply of flat colors. Bins, tables, jigs, fixtures, and tools are painted in contrasting colors. The operation of jigs and fixtures becomes clear in color as the inevitable gray shadows in black and white take on meaning. The motions and lack of motion in doing any particular operation are more easily defined. For instance, it is much easier to see what the fingers of the operator do in an operation, especially against a contrastingly colored background. This is important in the case where the skin and the background may reflect the same relative amounts of light, and tend to merge in black and white photography, even though they may be different colors.

As an added tip, when the camera operator gets used to color film let him talk to the sales force. It may be that they would like some films to show how well the product is made, and color helps there.

PRODUCTION METHODS AND MATERIALS

Recessed Screws Save Trouble in Ski Manufacture

H. S. KNOWLTON, *Boston*

In each pair of skis manufactured by Ed. Maynard, Inc., Plymouth, N. H., there are from 150 to 200 screws. With the ordinary type of screw, splitting of the head was a source of trouble. It was found to be almost impossible to drill out a small, broken screw without slippage of the screw itself, which results in making the hole larger. The hole then has to be filled with some suitable material and another screw inserted.

To avoid such troubles this company has used Phillips screws for about three years. They are commonly used in three lengths, because the thickness of the skis varies and the screws must go in as far as possible without coming through. The recessed-head screw very seldom splits and is faster to handle if the end of the screwdriver is magnetized. This keeps the screw from falling off the driver when inserted in the hole. A further advantage is that the screw is always centered in the power-driven screwdriver, which eliminates the wabble that results when the screwdriver gets off-center, keeps the head level, and does away with grinding.

Recessed-head screws are more expensive, but the time saved by their use is considered to offset price difference.

ANOTHER MONARCH LATHE
TO HELP KEEP AMERICA ON TOP
THE MONARCH MACHINE TOOL COMPANY SIDNEY, OHIO-U.S.A.
IMPROVED MACHINERY PROMOTES A HIGHER STANDARD OF LIVING

Lathes manufactured by the Monarch Machine Tool Company, Sidney, Ohio, are now shipped completely inclosed in plywood boxes. This step prevents damage caused by dust, dirt, and cinders to the highly finished bright parts which are protected only by slushing compound or covered by waterproof wrappings. In addition, the company is taking advantage of the opportunity to publicize machinery's contribution to our civilization by stenciling on the box sections such slogans as "Improved machinery promotes a higher standard of living" and "Another machine to make more goods for more people"

MAINTENANCE SERVICES

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

People and machines engaged in production must be supplied with buildings and with many services, such as electrical and mechanical power, heat, light, water, sanitary facilities, air conditioning, ventilation, dust collection, protection, communication, housekeeping. Providing these services and keeping them in condition for efficient production constitutes the Maintenance Service function. ¶ Practically every activity of maintenance service has to do with the Selection, Installation, Inspection, or Upkeep of equipment. For the benefit of FACTORY'S readers these classifications are carried at the top of the first page of each major article, and check marks are set against the classifications to which the articles belong. A fifth classification — Organization — is checked when the article deals with maintenance department organization and direction

DECEMBER, 1939, CONTENTS

Editorials 62

Electrical Instruments: First Aid for Maintenance and Production ..... *W. H. Ruehlin* 63

Seven Jobs Simplified With Portable Electric Tools 66

Maintenance Is a Job for Specialists ..... *G. W. Donovan* 68

Halves Chip Disposal Cost ..... *Glen Johnson* 70

Safety and Ease in Pushbutton Control 72

Capacitor Motors—a Safe Bet ..... *E. P. Codling* 74

Maintenance Service Shorts 76

Data Sheets: How to Prevent Freeze-Ups in Fire Protection Equipment 79

What's New in Equipment 84

Catalog Service 135

Maintenance Contents of the Three Preceding Issues

OCTOBER

Editorials 72
Capacitor Motors—When and Where 73
Just the Speed You Want 76
We Put It Up to 64 Flowmeters 78
Maintenance Is a Builder of Employee Morale 80
Hold On to Your Roof 82
Made an Old Plant Like New 84
Plug-In Electrical Distribution Insures Flexibility 86
No Wood, Less Fire 88
Bonus for Maintenance Supervisors 89
Maintenance Service Shorts 91
Data Sheets: Standards of Illumination for Industrial Interiors 93
What's New in Equipment 98
Catalog Service 147

SEPTEMBER

Editorials 70
Watch Out for the Wind 71
Unit Heaters Warm the Right Places 74
What About Incentives for Maintenance? 76
Maintenance Is Insurance Against Plant Shutdown 78
7 Jobs for Electric Heat 80
Used Meter to Pick Power Drives 82
Capacitors Reduce Power Bills 84
Interlocked Controls, Cut Delays 86
Maintenance Service Shorts 88
Data Sheets: Reflectors for Plant Lighting 91
What's New in Equipment 96
Trade Literature 138

AUGUST

Editorials 54
Matching Motor, Starter, and Load 55
Windowless—and It Works 58
How Chains Do Five Drive Jobs 60
Maintenance Is the Guardian of Our Plant Investment 62
Instruments Tell Quality Story 64
These Motors Laugh at Dust and Gas 66
Quick Exits for Smoke and Heat 68
Rewired for Profit 70
Maintenance Service Shorts 72
Data Sheets: Motor Troubles—Symptoms, Causes, Remedies (concluded) 75
What's New in Equipment 80
Trade Literature 118

FACTORY MANAGEMENT AND MAINTENANCE

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

EDITORIALS

L. C. MORROW . . . *Editor*

Cut Heating Costs by Filtering and Recirculating Air

TROUBLE MAY BE EXPERIENCED during cold weather in keeping comfortable working temperatures in rooms or departments from which large volumes of air are drawn off and discharged outside by an exhaust system. Even if there is no difficulty in keeping the area warm, the waste of heat may warrant efforts to cut it down.

A simple and effective expedient is to recirculate a suitable proportion of the air after it has been passed through a filter to remove dust particles. Absence of injurious fumes is, of course, assumed.

Advances made during recent years in design of air filtering equipment have notably extended its usefulness.

What Will Your Maintenance Budget Call For?

TIME FOR THINKING about next year's maintenance budget is at hand. What kind of budget will it be? The answer to that question is more important than is sometimes realized. Upon it may depend such consequential matters as the ability of a plant, under present conditions, to meet competition at a profit.

The budget may be figured so rigidly that it excludes everything not absolutely essential to operation of the plant. That is, expenditures may be designed to cover, roughly, only the cost of patching and repairing enough to get by. Corners may be cut, chances taken, everything skimped to the last degree.

To the uninitiated such a budget may seem, on paper, to be the height of thrift and good management. Experienced men know, however, that the policy that enforces or encourages such a budget is short-sighted and dangerous. Almost inevitably it results in unnecessarily high production and repair costs. All too soon the need for extensive replacement and rebuilding swallows up, perhaps many times over, any supposed saving in maintenance costs.

On the other hand, a budget—and this is the kind we recommend—may be based on the principle that preventing trouble is much cheaper than curing it. First off, provision will be made in it for an adequate force of competent men. They will be provided with all necessary facilities for handling their work promptly and efficiently. Emphasis will be placed on the importance of frequent, thorough inspection and immediate correction of abnormal conditions.

The budget will provide enough money and men to study causes of breakdowns and trouble. When they are found to be due to outworn or misapplied equipment, money will be available for equipment that will stand up under the service with the minimum attention.

Need for maintenance of plant buildings and structures will likewise be recognized. There will be provision for careful inspection of roofs, floors, and all other parts subject to wear and deterioration. Painting will be done, repairs of all kinds will be made as soon as need for them becomes apparent.

A plant with that kind of maintenance budget seldom has serious trouble with its equipment. Production flows smoothly according to requirements, rather than when and as machines can be patched up enough to keep going for a while.

In the long run a budget that provides for that kind of maintenance service is the cheapest possible. Through improved service to production, it pays out in lower unit costs, increased profits.

A Maintenance Dollar Scrimped May Cost You Two in Fires

THERE IS NO NEWS IN THE FACT that curtailment of maintenance work was overdone in many plants during the past few years. It is true, in general, that the bad effects of neglect may not show up immediately. Eventually, however, deferred maintenance collects a heavy toll.

In a paper delivered recently before the Fire Service Extension School at West Virginia University, G. S. Lawler, Chief Electrical Engineer, Associated Factory Mutual Fire Insurance Companies, pointed out that from 1926 to 1930 the average yearly number of fires of electrical origin in industrial plants was 16.5 per cent of all fires. Such fires caused 17.6 per cent of the total fire losses. From 1931 to 1938 electrical fires constituted 19.8 per cent of all fires in Factory Mutual plants and accounted for 19.2 per cent of the total fire loss.

Therefore, one out of every five fires was of electrical origin, during a period when production was at a considerably lower level than in the pre-depression years.

Several factors may conceivably play a part in increasing the number of electrical fires, but all the evidence points in one direction: Maintenance of electrical equipment cannot safely be neglected.

Electrical Instruments

First Aid for Maintenance—and Production

WALTER H. RUEHLIN
Electrical Superintendent
The Electric Auto-Lite Company
Toledo

RATING OF THE MOTOR required on a certain application in one of our departments was considered to be 15 horsepower. The maintenance department felt that this rating was too high. To settle the dispute a recording wattmeter was cut into the circuit of the motor. After a good look at the chart we took the 15-hp. motor out and replaced it with one of 5-hp. rating. This inexpensive change meant that we replaced a motor that would have operated at about one-third its rating and helped to decrease our power factor, which costs money, with one that will be fully loaded and operate at high efficiency. From another standpoint, a $230 investment was taken out and a $130 investment put in its place.

Of Vital Importance

This simple incident shows why we feel that electrical instruments are of vital importance in the operation and maintenance of any industrial plant. The small plant may not have use for all the instruments mentioned in this article, but many of them can be used to advantage in any plant.

Our company operates 21 plants, in which a wide variety of products are made. In one way or another my responsibility embraces 12 of these plants. In the Toledo plant we operate 3,690 motors ranging from 400- to ¼-hp. size, with an aggregate rating of 12,500 horsepower. All motors of more than ¼-hp. rating are three-phase, 440-volt designs. It is our practice to use inclosed motors (totally inclosed, fan-cooled, splashproof, or explosion-proof) in practically all cases, because of their lower maintenance cost.

Controls used with these motors are of all types, depending on the size of the motor and the application.

Other power-using equipment includes 3 electric brazing furnaces; 11 baking ovens, averaging 2,000 cubic feet capacity each; 7 automatic carbon arc welders; 24 butt, seam, and spot welders ranging from 5- to 200-kva. rating; about 40 compound melting pots ranging from 1-qt. to 100-gal. capacity; 112 motor-generator sets of 100- to 8,000-amp. rating; and hundreds of soldering irons and pots. In addition, a total of 565 electrical testing instruments are used in checking products and processes.

Primary power is purchased under a contract that penalizes low power factor. Transformers required include three 60-cycle banks totalling 3,400 kilovolt-amperes, three 25-cycle banks

The author puts a motor-generator set through its paces, with the help of the load analyzer. After serving in the navy during the war, he joined the electrical department of Auto-Lite. Kept busy after hours by boxing as a professional one night a week and attending school three nights. Between times he took a course in flying and got his license. During the past ten years he has laid out and wired most of the company's new plants. Likes a friendly foursome of golf, but his scores have never yet made newspaper headlines. Does considerably better, say around 250 out of 300, with a .38 Colt. When possible spends his evenings experimenting with electronic devices, in his home workshop. Is a member of the Electrical Code Committee of Toledo

with a total rating of 1,800 kilovolt-amperes, and 23 35-kilovolt-ampere lighting transformers. To correct power factor a 1,000-kva. synchronous condenser is operated on the 25-cycle lines, and 1,800 kilovolt-amperes in capacitors on the 60-cycle supply.

The maintenance department employs 90 men, of whom 26 are electricians. Kinds of electrical testing instruments used by the maintenance department in keeping all this equipment in proper condition are shown in the accompanying table. These instruments save time and money by providing the maintenance men a means of solving their problems intelligently.

Following are some of the uses of these instruments, and the results:

We carry a considerable number of voltmeters of various ranges, but the most popular and most widely used is the multiple range, having five scales reading 0 to 3, 0 to 15, 0 to 75, 0 to 300, 0 to 750 volts. The lower ranges are used to measure voltages and drops in plating and other low-voltage systems, both alternating and direct current.

The 150-volt range is used chiefly on lighting circuits. Voltage is measured at the lamp socket to determine whether the lamps are receiving their rated voltage. Most economical operation of lamps is obtained only when they are operated at their rated voltage.

To Prevent Slowdowns

The ammeter is of no less importance. We have these in a number of ranges. The most commonly used are those reading 0 to 5 and 0 to 50 amperes. The 5-amp. size is used to test both large and small circuits. One use for this instrument is detecting overloaded conductors. A conductor that is carrying more than its rating in amperes means overheating, voltage loss, and slowing down of production. This effect is particularly noticeable with heating appliances such as soldering irons, ovens, and compound pots.

The clamp-type ammeter is also used in making similar tests. It is much faster to use and more convenient for some kinds of testing than the conventional ammeter, although not quite so accurate.

The load analyzer is useful for analyzing single-phase or polyphase equipment such as motors and transformers. It consists of a wattmeter, voltmeter, ammeter, and power factor meter. We use it primarily for testing motors. Connections can easily be made, and readings can be taken as fast as you can throw the voltmeter and ammeter switches. The analyzer will show an unbalanced condition, whether the voltage is too high or low, whether the motor is overloaded due to excessive watts input, and the power factor.

The insulation resistance meter is also a useful instrument, most commonly used for checking the condition of cable, condensers, electrical windings, and so on.

It could be called a trouble anticipator since by periodic testing any weakness in the insulation can be detected before actual breakdown occurs. High-voltage tests can be used, of course, to detect weak spots in insulation, but by this method it is not uncommon to break down the insulation, thereby making a repair job which possibly could have been avoided. We use the insulation resistance meter in the production, laboratory, and maintenance departments and have a lot of respect for it.

Recently we had the job of locating a defective busbar insulator on a system which showed a leakage. This bus is supported on several hundred insulators and it would have been quite a task to take them out to be tested in the shop. Instead they were left in place, and the process of elimination was started by temporarily isolating one insulator at a time from the bus and giving the remainder an insulation resistance test. Contrary to the usual run of luck, the defective insulator was found about halfway down the line.

The recording wattmeter and the power factor meter are two other valuable instruments that are always on the job, even when we are asleep.

In one plant we were anticipating a decided increase in production and were not sure that the present bank of transformers was capable of handling the additional load; therefore the two recorders were set up.

The power factor chart showed approximately 95 per cent power factor at full load, and told us that by adding power factor correction equipment we could not release enough power to handle the additional load.

The wattmeter chart showed a load of approximately 265 kilowatts or approximately 280 kilovolt-amperes. Since the transformers were rated 300 kilovolt-amperes and the increase would equal the present load, we knew exactly what the conditions were, and all guesswork was eliminated.

Occasionally an operator is time-study-shy and does not like to have a man behind him with a stopwatch. In such instances a recording wattmeter can often do a fairly good job of timing operations.

One of the illustrations shows a section of a chart taken during one of these studies. It gave the time-study people the information they were seeking, without personal effort. Specifically, the chart showed that one of a group of four operators was not exerting the effort necessary to turn out good work. Since all operations were identical, a comparison was made of the effort exerted by each operator and a wide variation was found. One operator was putting out almost twice as many pieces as any one of the other three, but was exerting only one-half the effort, with the result that much of his output was defective.

The answer to this problem was to remove the responsibility for physical effort on the part of the operator. Now all parts are of equal quality, and scrap has been reduced to an almost irreducible minimum.

All charts are filed for future reference, with complete information as to the type and make of the machine, part

INSTRUMENTS THAT SOLVE MAINTENANCE PROBLEMS

A.c.-d.c. double-range voltmeter	*D.c. milliammeter*
A.c. low-reading, double-range voltmeter	*D.c. low-reading ammeter*
A.c.-d.c. five-range voltmeter	*D.c. precision ammeter*
A.c. recording voltmeter	*Polyphase indicating wattmeter*
D.c. double-range voltmeter	*Single-phase recording wattmeter*
D.c. millivoltmeter	*Polyphase recording wattmeter*
D.c. precision voltmeter	*Load analyzer*
A.c. milliammeter	*Recording power factor meter*
A.c. 0-5 ammeter	*Foot-candle meter*
A.c. 0-15 ammeter	*Cycle counter*
A.c. 0-50 ammeter	*Potentiometer indicator*
A.c. 0-100 ammeter	*Wheatstone bridge*
A.c. recording ammeter	*Electron tube tester*
Clamp-type ammeter	*Cathode ray oscillograph*

machined, number of pieces per time unit, speed and size of pulley or gears and so on. When a complaint is received that a machine is not operating properly, its record is referred to and a recheck made. The cause of the complaint, instead of being the motor, is often found to be dull tools, tight machine bearings, loose and improperly contacting belts, or perhaps a change in material, speeds, or other factor. The recording wattmeter settles a good many arguments in these cases and is a reliable source of information.

Measuring Voltage Variations

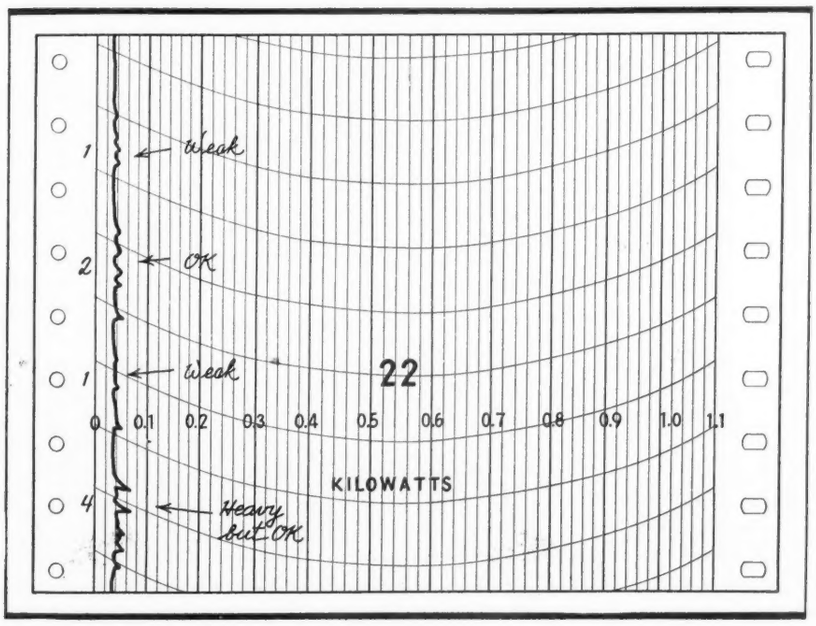
The recording voltmeter is constantly used for measuring voltage variations from day to day, and fluctuations during operating hours. We determine whether the variations or fluctuations in voltage are consistent. The tests may be made over a period of hours, days, or weeks, depending upon the conditions we expect to find or the reason for the test.

For example, a department head complained that certain pieces of electrical equipment were not performing satisfactorily and requested that we make a thorough check of the machines. This was done and a few minor adjustments were made, but with no better results. Next we set up the recording voltmeter and left it there for some time. The record showed that the machines were getting normal voltage, an average of 455 volts, but also that there were line fluctuations of about plus and minus 3½ volts.

It seemed unlikely that such a fluctuation on power equipment would cause trouble, but since the machines perform a delicate operation we waited until we had a chance to operate one when other loads were off the same feeder. During this period the results were perfect. The job then was to eliminate the fluctuation. This was done by increasing the size of the feeder. By so doing line drop was reduced, the fluctuations eliminated, and rejections stopped at once.

Another use of the volt recorder is in locating grounded equipment. If our ground detectors show periodic grounds, the recorder is connected to the system. Quite often, these faults are rapidly located with the help of our time-study department.

Recently a ground kept appearing at regular intervals. The recorder was set up and showed, after a few hours' run, an average of 130 grounds per hour. This meant that the trouble was in a welder or some piece of equipment that was energized for each operation. From the time-study department we found that out of several thousand pieces of equipment only three had this timing, and each was located in a different department. Luckily, the first one checked was the offender. This help was much appreciated, because hunting grounds is usually a long and therefore unnecessarily expensive job.



This wattmeter chart showed why one of a group of four workmen produced an excessive amount of defective work. Quality of the work was raised and rejects were practically eliminated by substituting mechanical means of producing pressure

We use the Wheatstone bridge chiefly for resistance measurements of conductors and in building resistors for use in production testing equipment. which when needed must be made quickly and be accurate in resistance value. In many instances the production department cannot wait for purchased resistors to be made up, since our requirements more often than not require sizes or values that are not regularly stocked.

The potentiometer indicator is an instrument that no plant can afford to do without, if the plant maintains its own heat-treating equipment.

This instrument is a big time and money saver in providing a means for accurately measuring almost any temperature, for testing thermocouples, temperature recorders, controllers, and indicators.

The cycle counter is used in process timing, such as on welders where the hold time, squeeze time, or weld time must be accurate. Once the proper set-up has been made, the timing is recorded and referred to whenever there is a change in set-up, thereby eliminating the production of a lot of scrap before the proper timing has been found by trial.

Check on Electronic Tubes

Our vacuum or electronic tube tester enables us to determine whether the tubes in our electronic devices can do the job that is expected of them. Formerly we took our tubes to some radio dealer to have them tested. Now this time is put to better use.

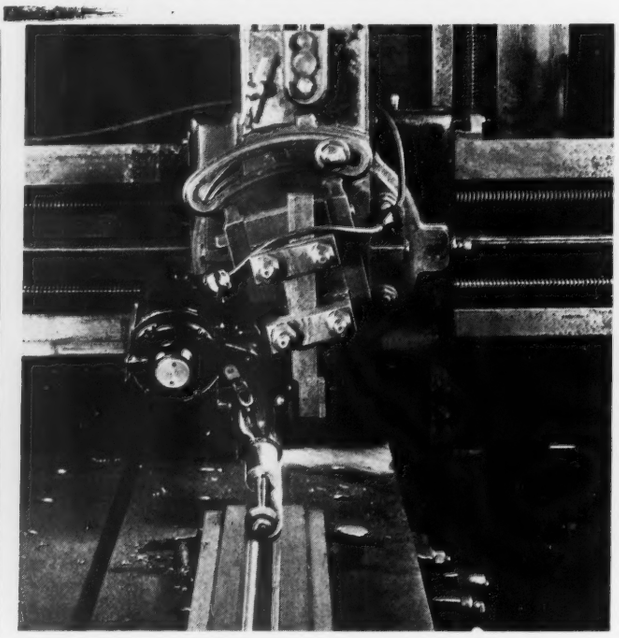
We use the cathode ray oscillograph for measuring current inrush to electrical equipment, such as welders and motors, studying voltage fluctuations, making frequency measurements, and when shooting trouble in electronic devices. It is very fast and sensitive. Ordinary electrical measuring instruments cannot measure instantaneous values because their response is altogether too slow.

More often than not the electrician is the first one called in case of trouble, regardless of whether the electrical equipment constitutes a minor or major part of the machine involved. He must first prove that the trouble is or is not electrical. If it is not, he is usually expected to point out the source, and he usually can. Therefore, the better equipped he is with instruments, the quicker the trouble will be located.

Seven Jobs Simplified With Portable Electric Tools

Easy-to-handle grinder (Independent Pneumatic) speeds up production in weld grinding and in foundry work

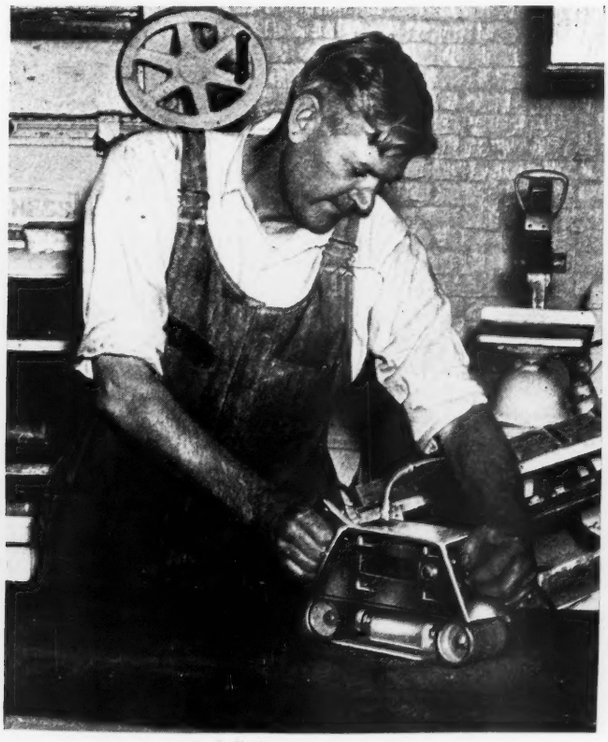
Cutting a hole in steel plate, when equipped with a hole saw, is only one of the jobs this versatile drill (Black & Decker) does



Grinding a radius on a rubber mold, a job requiring mirror-like finish—a difficult job handled by a precision grinder (Dumore)

Portable shear (Stanley), which cuts up to 18-gage steel, is rigidly mounted to trim the flange on a nickel-silver tray

Radio chassis assembly is much faster, costs are lower, since an electric nut-runner (Chicago Pneumatic) was put on the job



Work table tops are refinished with this sander (Porter-Cable) at regular intervals, to promote cleanliness and efficiency

Lead up to 4 inches thick is cut by electric hand saw (Skilsaw), which is also used to size lead sheets and cut other metals

Maintenance Is a Job for

G. W. DONOVAN
Plant Engineer, Monsanto Chemical Company
Monsanto, Ill.

IN THE OLD DAYS the master mechanic and his group of repair men were the magicians who presumably cured all maintenance ills. Today, the ability of skilled mechanics is combined with the technical training of engineers. And to keep this combination geared up so that it functions smoothly, maintenance must be just as thoroughly planned as production.

So important has specialization become to the maintenance department, that we here at Monsanto have split up the old master mechanic's job into five key craft heads. Each man is skilled in his craft, is responsible for his unit. He alone directs the men under him.

Working between the craft heads and the head of the department are the assistant engineers. These men lend their technical training to the practical men, subdivide the plant by departments, and work in the capacity of advisers to both the production men and their own mechanical foremen. They are the liaison division between the head of the department and the workmen. The lines of authority are carefully drawn, each man having his own individual spot in the division, and by careful hewing to the line close harmony is created and the division operates as a unit. By education we have built up on the one hand a respect by the engineer for the practical knowledge of the mechanical foreman; on the other, the foremen accept the technical training of the engineers.

Maintenance service to production begins before the production unit is built. In any apparatus, the time will come when repairs or replacements are needed, and the maintenance engineers work in close touch with the designing force to anticipate this time, viewing the project from such angles as accessibility to repair and time of replacement. They offer suggestions based on their field experience. They become thoroughly familiar with the project, so that when breakdown occurs they can remedy it quickly and surely.

This same thought is carried further into the maintenance organization. The different craft foremen study the projected unit, know what their future work involves, are asked for and offer valuable suggestions toward preventing future breakdowns.

The best way to prevent breakdown and lost time in the production cycle is to anticipate it. Inspection services are a big part of a good maintenance organization. We, for example, established a rigid electrical inspection service to cover every item of electrical equipment. And it pays dividends.

In 1934, out of 623 motors running we had 39 burn out. In 1938, the number of burnouts was 34 out of 1,150 motors. This meant a big decrease in unit shutdowns. Why? The electrical craft applied its skill, the technical man his thought. Motors were oiled and cleaned on regular schedules. The engineer kept records and noted that nearly all the failures occurred in open-type motors. Today all new motors installed are totally inclosed.

Down the Line

This inspection is carried on down the line. The machinist division—the millwright who was half machinist, half carpenter, has disappeared—carries out an inspection-oiling schedule of the entire plant. Every piece of machinery is inspected, oiled, or greased according to carefully worked out schedules. The oiler on his trip makes minor preventive adjustments, and notes the need of attention to a bad spot. Possibly the lubricant is in doubt—advice is asked from a lubricating engineer, and his recommendation is followed.

The construction foreman inspects his buildings—they are his for he has been taught to feel that they are—and painting or repairs are done or made on his recommendations or according to predetermined schedules.

Sprinkler systems are inspected daily and check-tested weekly, and at longer periods cleaned. Even the heads are visually inspected periodically. A broken head can cause a shutdown. The inspections are carried even to the yard areas, for a clean plant has its effect on morale.

Why this careful inspection in such detail? It does cost money, but nothing in comparison to what a long unit or department shutdown would cost. It is a part of organized maintenance that management recognizes as vital to continuous plant operation.

Costs are vital in maintenance work as well as elsewhere. The maintenance organization must furnish its services as economically as possible. Due to the nature of materials handled in the chemical industry, our plant maintenance costs are high. Each foreman and his sub-foremen, however, have been instilled with the spirit of watching these costs as a part of their individual responsibilities. They keep their own records with pride.

A pump was giving trouble, breaking down steadily. At a suggestion from the machinist foreman the design was altered in a small way. The life of the pump jumped from three months to over one year.

The engineers do most of the job-cost estimating, but what they really check is the cost after the job is finished. And they have to tell each craft foreman what his costs were. He wants to know, so that he can better the figures when the job comes up again. Interest in these figures proves that each individual feels he is a part of the recognized service that keeps his plant running. It is organized spirit.

Spare parts are necessary. Production tries never to be caught without a container to take care of that extra order. Maintenance must not be caught without that spare part that is vital to prevent any shutdown of consequence. This takes careful and exacting thought. Inventories of such items cannot be too large, but they must provide adequate coverage. Here is where the practical training and long experience of the foreman comes in. He can, from practical knowledge in his division, write down the necessary minor spares

Specialists

A mechanical engineering graduate of Massachusetts Institute of Technology, Mr. Donovan started his professional career with Lockwood-Greene Engineers shortly after the World War, and spent most of his time on a Virginia construction project. In 1921 he went to the Merrimac Chemical Company in Boston as construction superintendent. Following the purchase of Merrimac by Monsanto, he was transferred to his present location, where he is now in charge of construction and maintenance. His few spare hours away from the job are devoted to his family or to his favorite hobbies of golfing and fishing. In the above photograph, the candid camera has caught Mr. Donovan in the act of telling one of his department foremen how to tackle an especially husky maintenance job

needed, the pieces of a machine that are apt to break down suddenly. The maintenance engineer, working with the production man, can work out the major spares needed. By putting the recommendations of the maintenance organization together, a fairly complete list of necessary spares will be assured.

We have noted the combination of skilled foremen and technical engineers. Today there is another change. The workman is a craftsman. The handy man is gone. Plant management recognizes that with the extensive field of modern machinery, the various metals, the extensive electrical control equipment, the mechanic today must be a specialist, not a jack of all trades. A welder must know his stainless as well as his plain steel. The machinist must know what is inside his intricate gear reducer, not only pulleys and leather belt. The electrician no longer merely puts in light bulbs and tapes up open wires. Today he is working on safe control equipment.

Plant maintenance has gone modern. Organized to prevent that breakdown, to keep the production cycle going, it is the key to successful production.

Halves Chip Disposal Cost

Sub-floor system removes 5 carloads of chips a day from 50 machines; add new stock distribution plan and the result is much better handling for 50 per cent less money

GLEN JOHNSON

General Manager, Bower Roller Bearing Company, Detroit

DISPOSING OF FIVE CARLOADS of automatic screw machine chips per week is no small task. Moreover, with 50 machines placed in an area 220 by 60 feet, little space may be devoted to the mechanics of this disposal.

A little over a year ago, expanding business made it necessary to erect a building to which these 50 automatics could be moved. Starting from scratch, as it were, the building was specially designed to house these machines and the equipment needed to handle the great quantities of chips and cutting oil required in metal-working operations of this magnitude.

The building is 80 feet wide and 220 feet long. Twenty feet of the width, however, is taken up as storage space for the 12-ft. bar stock used. The machines are placed in two parallel rows with the feed ends pointed toward the center. In this central area the bar stock is placed preparatory to its use on the machines. Stock for each machine has its own assigned space. These individual stock piles are replenished from the storage on the opposite side of the building by a monorail hoist. Two switches permit the hoist to operate the length of the building, over both the stock storage and the machine supply stations.

Machines are spaced only 2 feet apart, too little space for a man to go between machines to remove chips.

Under the feed racks of the machines the means of chip disposal is provided. It is under the floor, out of the way. Two tunnels, one for each row of 25 automatics, and each 3 feet square, were sunk below the floor level when the building was erected. One side of each tunnel is flush with the line of machine bases, and each tunnel is covered with a grating at the floor level.

One man is required to operate each chip disposal line, and both of them are kept busy servicing the machines in rotation. When chips are to be removed from the machine base, the chip disposal man lifts a hinged section of the floor grating, rakes the chips into a traveling hopper in the tunnel, replaces the grating, and works the hopper along the tunnel to the next machine. When the hopper is full, he sends it to the end of the building where it is emptied into a centrifugal machine. One centrifugal is provided for each tunnel. These centrifugals are placed in a pit, below the level of the tunnels. The tracks on which the car runs, are turned downward at the pit to aid in raking the chips into the centrifugal machines.

The chip man may then bring the car back to whichever of his 25 machines he may wish to service next.

Two Things to Think About

In directing the movement of the hopper car, the chip disposal man need concern himself with only two things. If he wishes to have the car stop at machine No. 9, for instance, he pulls a dropcord in front of that machine. Wiring for the controls that operate the hopper car is inclosed in duct that runs the length of the building, a dropcord being provided at each machine station. Pulling the cord opens the shorted-out solenoid coil at machine station No. 9, which in turn starts the motor that operates the tunnel conveyor to bring the car to station No. 9.

When the car is full, the chip man steps to a pushbutton, one of several located on building columns along the machine rows, which is connected with a master control relay in the contactor panel at the end of the chip conveyor. Pushing the button energizes the contactor, closes all machine station switches, and sends the car to the pit where the centrifugal machines are located. The contactor maintains its own holding circuit until broken by the three-way switch in the selector panel corresponding to the dump position of the car. After all the chips have been dumped into the centrifugal machine, the pit operator pushes a button which lights a pilot light in view of the chip conveyor operator. The latter may then pull the cord at the next machine station he wishes to clean, and the car will return.

No wiring or electrical apparatus of any kind is located in the tunnels. The car runs on two rails elevated about a foot above the bottom of the tunnel. It is attached to an endless chain operating over two sprockets, one a driver at the pit end, and the other a take-up at the opposite end.

The 2-hp. motor that drives the chain is placed at the pit end of the chain where the chips are emptied. Here it is well protected from both oil and chips. Reversal of direction is accomplished by reversing this motor, which is connected to the chain through reduction gears.

At the edge of the centrifugal pit, just above the drive motors, are the electrical controls that operate the system. Two panels are used, one a station-selector panel that positions the cars along the machine lines, the other a contactor panel whose operation sends the car to the pit. The first is actuated by the dropcords at each machine station, and the second by the pushbuttons already mentioned.

The horizontal station-selector panel consists of a lead screw which drives a traveling block from one end of the panel to the other, and 26 three-way tumbler switches of special design. Each switch operates in response to the controls at its corresponding machine station, and determines which direction the motor must travel to reach the station energized. The traveling block moves on the lead screw in ac-

cordance with the car's movement in the tunnel.

The contactor panel consists of a forward and reverse motor contactor; a forward and reverse auxiliary contactor, which prohibits the operation of two stations at the same time; and a master control which is energized only when sending the car to the dump. This master control opens all machine station circuits and operates the car in a forward direction only—that is, to the dump, with no other stops possible until it has reached that point.

How It All Works

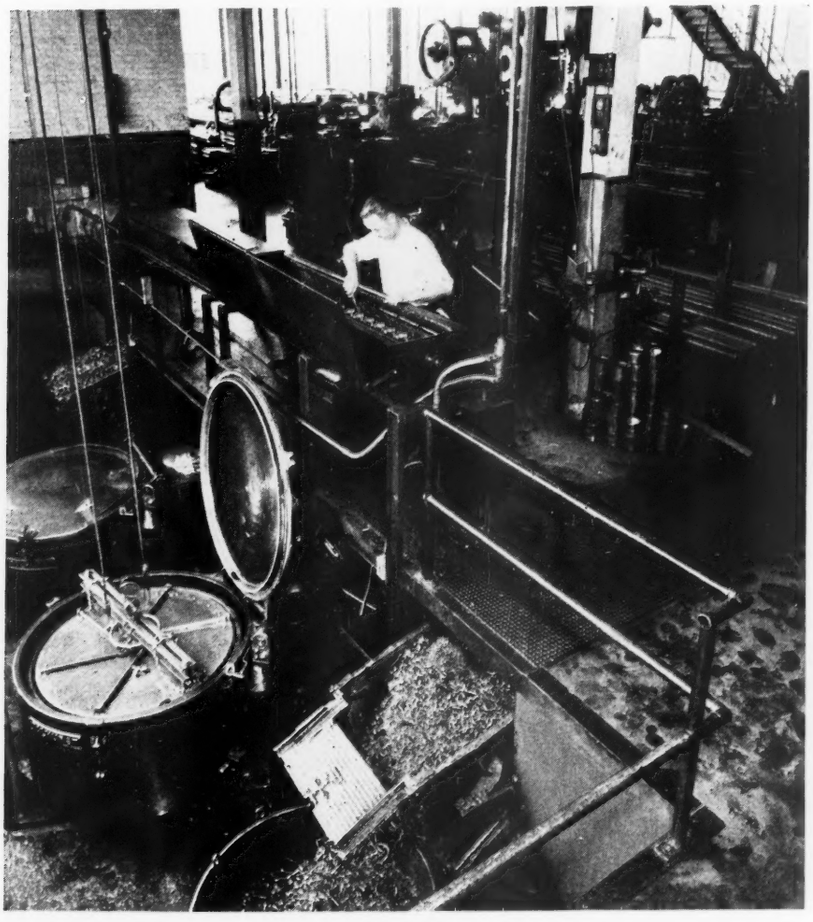
Each of the 26 machine stations consists of a three-way switch, a solenoid, and a mechanical latch which is operated by the solenoid. The three-way switch is actuated by a lever protruding from a slot in the metal case. The lever is held in position by a spring, and its movement when the dropcord is pulled is against spring pressure.

Movement of the lever at the machine station opens the circuit from the common to the top contact of the three-way switch, and closes the circuit from common to bottom contact. The solenoid is connected to the common and top contacts; thus it is shorted out when the station is inoperative. When the lever is pulled down to bring the car to that station, the short is removed, and if the solenoid is energized the mechanical latch engages the lever to hold it in the down position until the solenoid has been de-energized.

Wiring is as follows: The common and top contacts of all stations are connected in series, which means there is a continuous circuit across all the shorted coils. One line is connected to the common contact station, its top contact to the common of the second station, and so on. The top contact of the station No. 26 is connected to the load side of a contactor which, when closed, connects the last station to the other side of the line. This would mean a short circuit if the contactor were to close, but it closes only with the motor starter, and the starter can be operated only from the machine stations which, when energized, immediately insert a coil in the circuit to provide the proper resistance. The line is also opened when the master control is actuated, to allow the car to run to the pit, which has no machine station.

The bottom contacts of the machine stations are connected to the common contact of the three-way switches in the selector panel.

There is a good bit of oil pulled out of the base of the machine while the operator is emptying the chips. This drops immediately into the tunnel. Oil also drains from the car during its movement back and forth. The tunnels were constructed with a pitch of 18 inches in 200 feet, which provides drainage toward the pit end. The oil runs out of the tunnel into a sump in the pit bottom. From here it is pumped to a separator, along with oil from the centrifugal machines, and is purified and returned to the automatics.



Principal elements of the chip disposal system are visible in this view. The two full hopper cars have just emerged from their tunnels and are about to dump chips from the machine lines into tubs which will be lifted into two centrifugal machines in the center. Above these machines, at the edge of the pit, are two electrical control panels which keep cars going where they are needed. No failure in 18 months' operation

No Bugs in the System

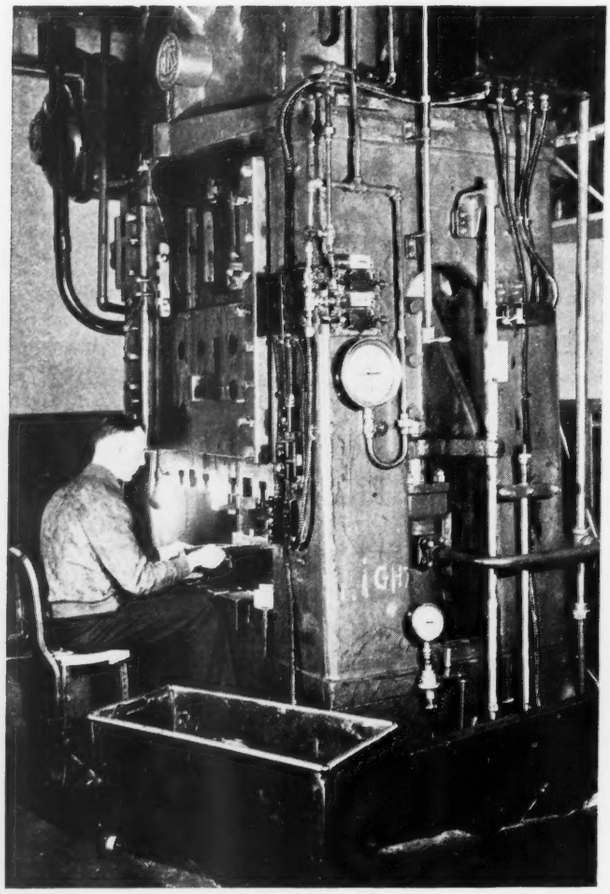
After 18 months of operation no significant faults have developed. No trouble is encountered from chips clogging the car and chain in the tunnel. Since the dimensions of the car are the same as those of the grating that is raised when a machine is to be cleaned out, there is very little chance of spilling chips into the tunnel. Then, too, the fact that the car is elevated a foot above the tunnel bottom tends to keep the tunnel free of chips. Nevertheless, the tunnels are cleaned out once every three months.

No sawdust is used around the automatics. Operators are provided with squeegees which they use to push oil accumulating in the working space between machines into the tunnel.

The tubs from the centrifugal machines are raised from the pit to a car which carries them to an outside pit a few feet away, adjacent to the railroad siding. A crane running over this outside pit dumps the tubs in storage piles according to chip classification. A bucket elevator then loads the chips into the railroad cars.

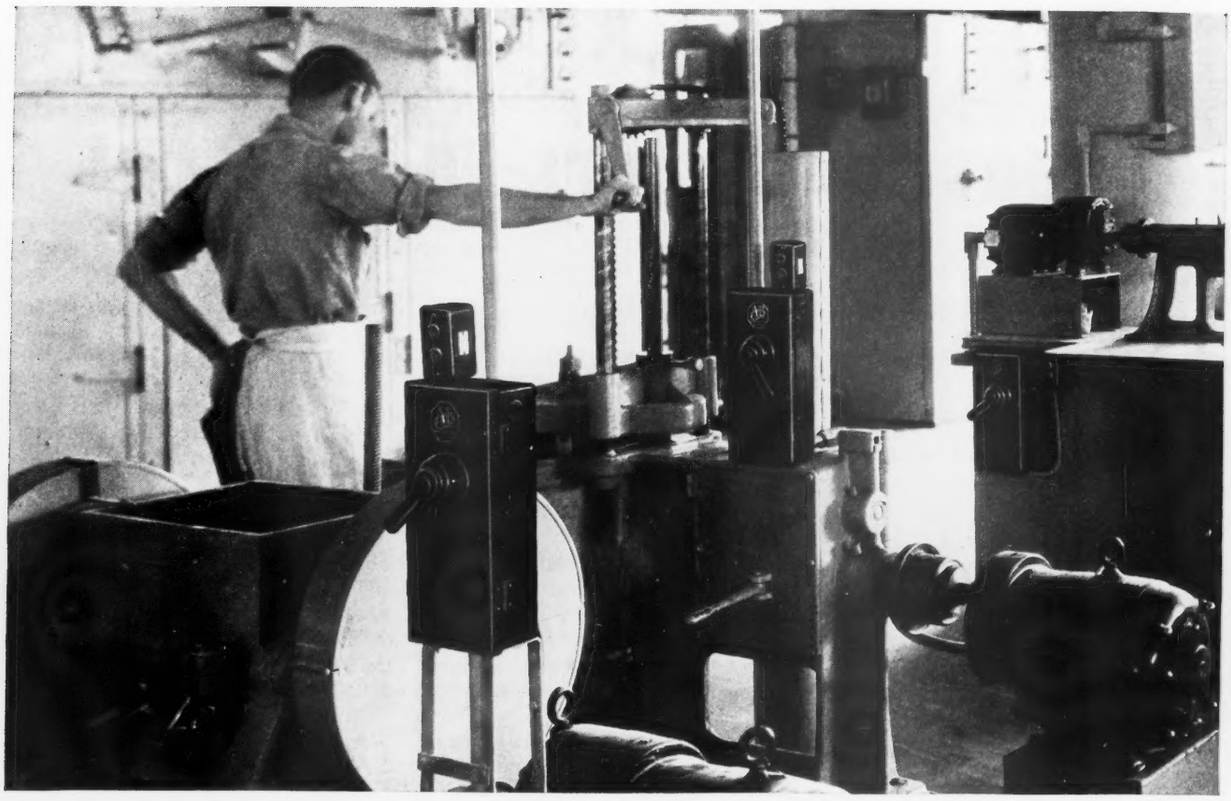
A very satisfactory cost reduction has been secured by this method of stock handling and chip disposal. On a three-shift basis it has meant a reduction of just about 50 per cent in these two costs.

Safety and Ease in Pushbutton Control



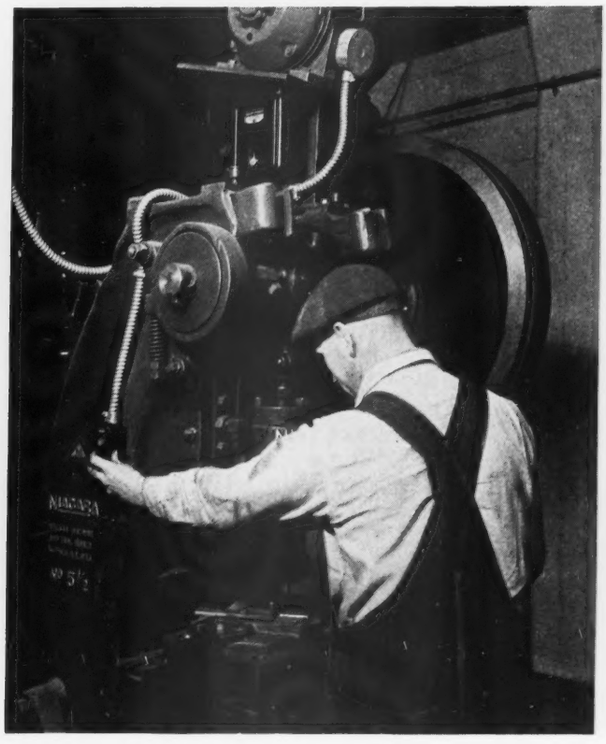
Safeguarded by photoelectric control while he positions heater plate, operator simply pushes button (Westinghouse) when ready

From two pushbutton stations (General Electric), the operator controls seven motors that drive this horizontal milling machine



Combination switch (Allen-Bradley), made up of manual disconnect and pushbutton-controlled starter, controls three mixers

Pushbutton operation (Allis-Chalmers) and metal inclosure of all live circuits protects operators and equipment in a rubber plant



Pushbutton control (Cutler-Hammer) on punch presses and other machine tools simplifies operations, takes hands out of danger

Capacitor Motors—a Safe Bet

1. When and where to apply the different types

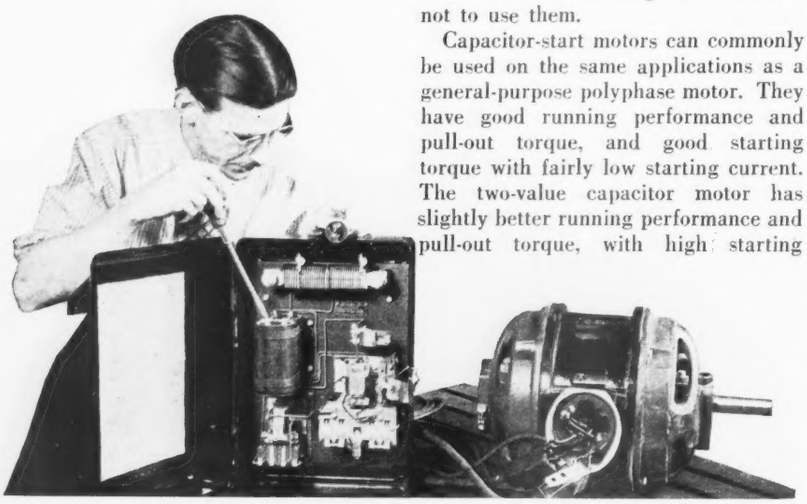
2. How to inspect and keep them in proper shape

E. P. CODLING

Motor Engineer, Westinghouse Electric & Manufacturing Company, Lima, Ohio

A PRECEDING ARTICLE in the October issue discussed the types and characteristics of the capacitor motors now available. Applying these motors is just as simple as applying the polyphase induction type to any normal application. The single-value motor can be used only on direct-connected fans and blowers, or applications where the starting load is extremely low, as shown in Table I. They have good running performance, are quiet in operation, and are well suited to these applications. When in doubt as to the starting load it is best not to use them.

Capacitor-start motors can commonly be used on the same applications as a general-purpose polyphase motor. They have good running performance and pull-out torque, and good starting torque with fairly low starting current. The two-value capacitor motor has slightly better running performance and pull-out torque, with high starting torque and low starting current. It can commonly be used on those applications where high-starting-torque polyphase motors are applied. It is the most expensive and for that reason it is being replaced in the fractional-horsepower sizes by the higher-torque capacitor-start motor.



In this instance electrolytic capacitor and control circuit for a capacitor-start, induction-run motor are mounted in the starter cabinet. This pump drive motor is of the single-phase variety, is rated 5 horsepower, 1,750 r.p.m., 220 volts, 60 cycles

In some instances further consideration must be given to the difference between the characteristics of capacitor and polyphase motors. Since the capacitor-phase current remains practically constant from no-load to full load, the capacitor motor may run just as hot at no-load as at full load. When applying capacitor-run motors (not capacitor start) to varying loads this fact must be given consideration and the rating based more nearly on the maximum horsepower rather than the root-mean-square horsepower.

If the motor is to be used on an application that requires an extremely long starting period, frequent starting, or where it may be plugged to a stop, it is necessary to check the complete design. One must make sure that the proper motor characteristics will be obtained; that the allowable capacitor voltages will not be exceeded; and that the control will function properly under this kind of service. Such service is not considered standard for these motors.

Capacitor motors require the same care and maintenance needed by all squirrel-cage motors. The capacitor requires no maintenance other than keeping the terminals clean. The elements

Table I—Characteristics and Applications of Integral-Horsepower

Type of Motor	*Type of Rotor*	*Speed*	*Efficiency, Normal Load*	*Power Factor, Normal Load*	*Starting Torque*	*Pull-out Torque*	*Starting Current*
Capacitor start and run	**Squirrel cage**	**Constant**	**Fair**	**Very good**	**Very low**	**Fair**	**Fair**
Capacitor start—induction run	**Squirrel cage**	**Constant**	**Good**	**Fair**	**Fair**	**Fair**	**Fair**
Capacitor start—capacitor run	**Squirrel cage**	**Constant**	**Very good**	**Very good**	**High**	**High**	**Low**

should be protected from damage, and with electrolytic capacitors the case should be kept insulated from ground by keeping it clear of conductive dirt and oil.

Transformers require only that the insulation be kept in good condition and free from injurious materials.

The control, including centrifugal switches, must be kept free from injurious substances, and be given the care required of all such equipment. Some types of controls can be mounted in any position; other types can be mounted in one position only because of the effect of gravity on the moving parts.

If trouble is experienced the motor may be subjected to the inspection and tests ordinarily applied to polyphase motors. When power is applied only to the main phase the motor should not start, but if the bearings are free it can usually be made to start and come up to full speed by giving it a spin. No-load current of the main phase should then be somewhat less than full-load current. The capacitor phase should be insulated when this is done, since a voltage will be induced in it.

At standstill the current drawn by the main phase should be in the neighborhood of 500 per cent of full-load current, whereas the capacitor-phase current is normally somewhat less. Resistance of the capacitor phase is commonly, but not necessarily, considerably greater than that of the main phase, and may be up to five times as great.

Shorting the Terminals

Before examining the capacitors it is always advisable to short the terminals, so as to remove any charge which may be present. This procedure must be repeated each time after applying voltage. Normally these capacitors are of a type which will lose the charge after a brief time, and are connected in such manner that the charge will leak off through the transformer or motor windings, or are supplied with a discharge resistor. This safeguard should not be relied upon, particularly when running down trouble on large motors, where the voltage may be quite high. Possible voltages present may be several times the magnitude of the line voltage. Since this voltage may be wired into the motor or control, precautions should be taken before touching any of the parts which may be live.

About all that can happen to the capacitor element, other than mechanical trouble which would be immediately apparent, is shorting. This condition is commonly accompanied by bulging of the element case. Any bloated elements should be immediately suspected. Most elements are marked with a label indicating the maximum voltage rating and the microfarad capacity. The capacity may be checked approximately by applying a suitable alternating current voltage, reading the current, and substituting the proper values in the formula:

$$Microfarads = (1{,}000{,}000 \times Current) \div (2\pi \times Frequency \times Voltage)$$

When making this check a fuse or other protective device should be connected in series and the voltage first applied with the ammeter shorted to prevent damage to the meter in the event that the capacitor is shorted.

If replacement of capacitors becomes necessary they should, if possible, be obtained from the original motor manufacturer, giving complete motor as well as capacitor identification. For emergency use it can usually be assumed, in the absence of definite information, that continuous-rated capacitors are rated 330 or 440 volts continuous when applied to either 110- or 220-volt motors, and that electrolytic capacitors are rated at 110 volts when applied to either 110- or 220-volt motors.

In some instances matched capacitors are used in series, and when replacement is necessary similarly matched units should be used. After replacing a capacitor, particularly if it is not definitely known that it has the proper voltage rating, it is desirable to check the voltage obtained across it: (1) when the motor is stalled; (2) just before transfer is made; (3) at no-load, if used continuously. These are the possible points of highest voltage. If any of these voltages exceeds the rating of the capacitor, after making allowance for intermittent operation, short life may be expected. High ambient temperature is detrimental to the life of most capacitors, and should be avoided.

Transformers sometimes burn out due to high ambients, poor cooling, or capacitor or control failure. No general test procedure can readily be given. Excessive heating or damaged insulation will generally indicate the condition of the transformer. Of course, with a shorted transformer reduced starting torque will usually be encountered. Ratio tests can be made if the ratio is known. No-load, open-circuit tests at the operating voltage will detect faults, but they require design data.

Check Diagrams for Trouble

Connection diagrams are normally supplied with external controls. Control trouble can best be found by carefully checking this diagram and examining the relays to see that they are functioning properly. The diagram will indicate what relays operate to provide the starting connections, and how and when the transfer to the running connection is made. If the control is of the time-delay type instructions will probably be given for adjustment of this time. Adjustment should be made carefully, making full allowance for increased time due to the maximum load and possible low voltage.

Controls actuated by a change in voltage or current are difficult to adjust in the field because of the impracticability of loading the motor to such an extent that it will operate continuously at the desired point.

Centrifugal switches should require no adjustment in the field. A careful examination will indicate whether wear has resulted in failure to function properly. The insulation should be examined for conducting material which might cause shorts. Contacts should be cleaned if necessary. Removal of the rotor and the bracket on which the switch is mounted and the assembly of these two parts will make it possible to operate the device manually in such a manner that operation can be checked. When reassembling the motor, take especial care that leads do not get in the way of moving parts of the switch, or short any of the live parts.

Capacitor Motors

Applications

Suitable only for direct-connected fans or similar loads where starting torque requirement including friction is low. Not dependable for belt drives.

General purpose fractional-horsepower capacitor motor used in smaller integral-horsepower sizes for general application. Will not take care of as high starting duty and heavy overloads as repulsion-start, induction-run motor.

General application such as machine tools, fans, blowers, and centrifugal pumps, and high starting loads such as loaded reciprocating pumps, compressors, conveyors, especially where quietness and freedom from radio interference are requisite. Starting torque is ample for all except severest conditions.

MAINTENANCE SERVICE SHORTS

Readers are invited to contribute brief illustrated articles reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for

BUILDINGS, SERVICES, MAINTENANCE

Type of Valve Indicates Type of Service

CHARLES C. LYNDE, *Kilgore, Tex.*

In processes where manual control of many gate valves is required, and where the saving of a few seconds may mean the difference between safety and disaster in the event of a fire, one plant utilizes different types of gate valves to indicate different kinds of service. With this means of differentiation, labeling or the use of a paint code is not required.

Steam lines to pumps handling raw material are all installed with valve stems projecting horizontally from vertical lines—and these are the only valves so located in the plant yard—so that the valve wheel is most conveniently placed for emergency operation.

Suction lines to all pumps are equipped with gates set horizontally, with stationary-type stems.

Valves on discharge lines, on the other hand, are rising stem valves, so that accurate, on-the-spot checking of valve opening is possible.

Rigid adherence to this valve scheme enables any employee, whether normally employed in this department or not, to make an emergency shutoff of a designated unit.

•

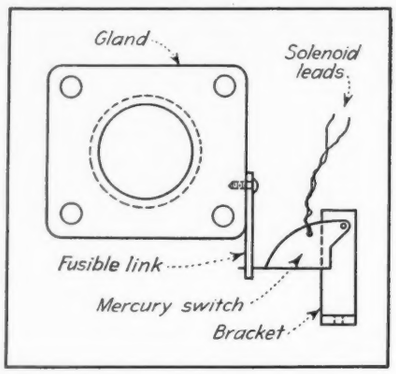
A fire hazard is created when steam pipe insulation stops at a point where the pipe passes through combustible walls or floors. Insulation should be continuous.

•

Fusible Link Safeguards Unattended Pumps

ELTON STERRETT, *Longview, Tex.*

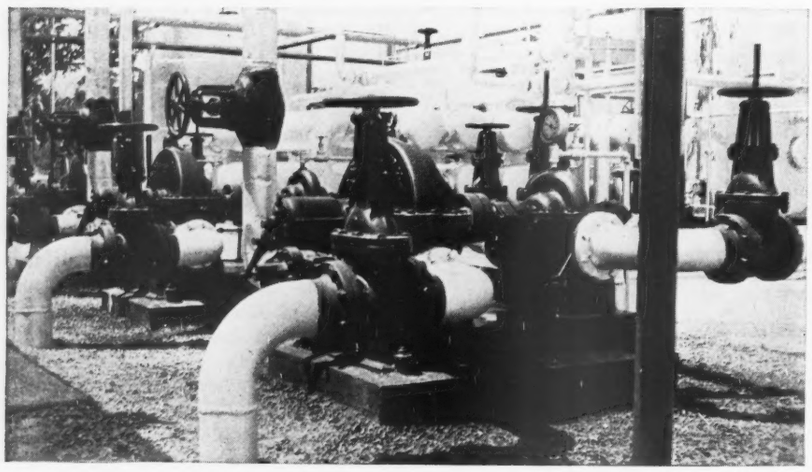
Many industrial pumps, both of the plunger and rotary positive pressure types, are largely dependent upon the lubricating qualities of the fluid being handled for preventing undue wear on packing and pump elements. Especially is this true where crude petroleum or any one of its various derivatives are being pumped.



When such a pump breaks suction, heat is rapidly generated in packing gland or pump body, resulting in damage to plungers, bearings, and rotors, unless power is promptly cut off. Since such pumps are frequently used for transfer work where attendance consists of little more than starting and stopping the unit, the provision adopted by one petroleum company for safeguarding its isolated units may be of value to others with similar installations.

Paint is first cleaned off the side of the gland—or from the bearing housing of a rotary pump—a fusible link is attached to the gland with a stove bolt, with the lower end of the link hanging free. A mercury switch is then pivoted from a bracket with its free end supported in the fusible link. This switch is connected in the ignition circuit if the pump be engine driven, or to a solenoid in the motor control box if electrically operated. With such a hookup, using the standard 135-deg. F. link, the power will be cut off when the pump reaches that temperature. Bearings and packing are thus protected against overheating.

Since the device is intended to protect only in infrequent cases of broken suction, the cost of link replacement is low, and one portable mercury switch assembly, on a bracket accommodating



Three types of valves, and their positions, permit instant classification of service

itself to pump installations, may be used to safeguard a number of pumps. Of course, where higher temperatures than 135 deg. F. are met in handling fluids, links of higher melting point must be used.

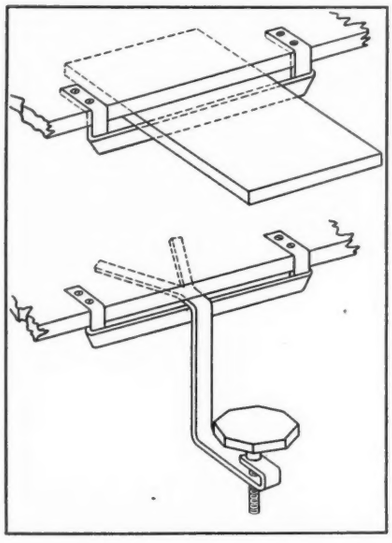
Such a switch will also cut out the pump quickly in case of fire around the gland, which is the only point where the fluid can normally escape to air and become ignited.

•

Workbench Attachment Supports Board or Seat

CHAS. H. WILLEY, *Penacook, N. H.*

Here is a workbench attachment that serves as support for a sliding board work surface, a mechanic's seat, or other attachment. It consists of a steel bar bent as shown and secured into the bench flush with both bench edge and top, with a space between the



underside of the bench and the portion of the bar that is parallel to the bench.

This bar forms a support for a sliding board, or supports a mechanic's seat. Weight of the seat or board holds it tight against underside of the bench.

•

Removing Broken Studs and Drills

W. E. WARNER, *London*

When taps, drills, or studs break off flush with or below the surface of a casting or forging, the removal becomes a problem. In many cases the principal difficulty is getting a grip on the tap, as the binding may not be severe. The binding may be due largely to chips, which are best loosened by acid treatment. But before this can be effective, any lubricant used must be dried up.

To do this, play a blow torch on the surrounding metal, and after it has been heated and allowed to cool, inject about ten drops of either nitric, sulphuric, or hydrochloric acid around the edges of the tap. Then take a rod of soft copper about four inches long, which will easily fit into the hole, and thickly tin one end. Place the end of this rod over the tap and hammer down on it. As the broken tap, drill, or stud is considerably harder than the tinned copper rod, and its end, due to the breakage, is more or less jagged, the end of the tap will drive into the rod and make a fairly solid joint. Then if the upper part of the rod is held in a pair of grips, the rod can be worked backwards and forwards, turned, and the tap finally screwed out.

How quickly the tap is removed largely depends on the strength of the joint—which depends principally on the jaggedness of the tap—and upon the tightness of the binding.

In many cases acid injection is not necessary, but it is advisable where the binding is strong. After acid has been used it must be neutralized; this can be done by making up a thin paste of powdered chalk and water, filling the tapped hole with it, leaving it for five minutes, then removing and drying.

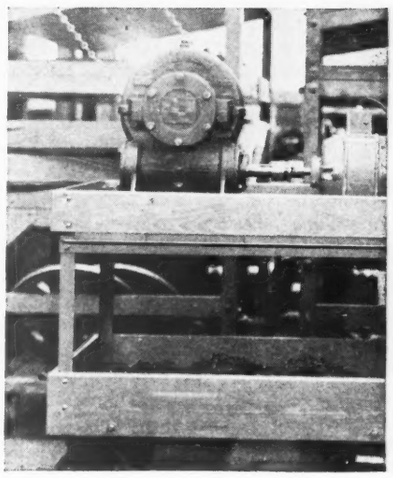
•

Skylight Opener Is Motor Driven

H. R. GRAHAM
Time Study and Methods
Fairmont Railway Motors, Inc.
Fairmont, Minn.

Skylights in our factory had heretofore been opened and closed by pulling on a chain running over a chain pulley geared to the window. The opening took about 15 minutes and was a long hard pull taking a lot of a man's stamina before the day's work was begun. It took almost as long to close windows although the pulling was not as hard.

At my suggestion the maintenance department took a ½-hp. motor and a gear box, hooked them up to drive a chain pulley, mounted the outfit on a truck, and moved it from one window opening chain to another to open and close the windows. By putting the pulley to the chain from opposite directions the window can be either opened or closed without reversing the motor. If a



gear box is not available, the motor speed can be cut down by belts and pulleys.

Now, the janitor can do the job in a very short time in the morning and at night, or in very hot weather the watchman can open the windows early in the morning to get that cool air into the plant before the workmen get there. By the old hand method, along with taking quite a bit of time, it was such a long hard pull that the workmen left the windows closed. Employee efficiency was cut down by improper ventilation. It now takes about one and a half minutes to open a window. You can readily see the saving in man-hours.

Any factory with upwards of five geared skylights can pay for the cost of making up such a skylight opener.

•

Sand Helps Lick Water Main Electrolysis

F. M. CARVER, *Maintenance Foreman*
Reliance Electric & Engineering Company, Cleveland

Stray electrolytic currents and soil of a corrosive chemical nature caused several sections of an 8-in. cast iron water main to develop severely corroded pits in their surface. Eventually, the sections leaked and had to be replaced.

The soil about the pipe was wet, indicating poor drainage conditions, and varied from dark-colored clay to black muck. It was examined by a chemist and found to be distinctly alkaline. Tests for stray electrolytic currents revealed potential differences in the soil of as much as 50 millivolts.

Although only a few sections were affected, it was evident, because of

similar unfavorable soil conditions all along the main, that leakage might be expected at other points unless all the pipe sections were treated.

To remedy these conditions it was decided to remove all the soil within at least a foot and a half of the pipe which lay from 4 to 8 ft. underground. To reduce electrolytic action the pipe sections were electrically connected by means of a bare No. 6 copper wire running the whole length of the main. This wire was attached to each section with ground clamps and, as a further precaution, carefully grounded again at both ends of the water line.

Treatment of the pipe surface itself was not overlooked. It was first painted with hot asphalt, then wrapped with asphalt-impregnated paper, and painted again with more hot asphalt.

Of equally great importance, the soil that had immediately surrounded the water main was not put back. Instead, it was replaced with a dry sand loam, secured from a different locality.

All of the foregoing work called, of course, for a certain amount of excavation. However, instead of digging a continuous, open trench through the working area of the plant, interference with manufacturing operations was held to a minimum by breaking holes in the concrete floor only at 15- to 20-ft. intervals and tunneling around the pipe that lay between these points.

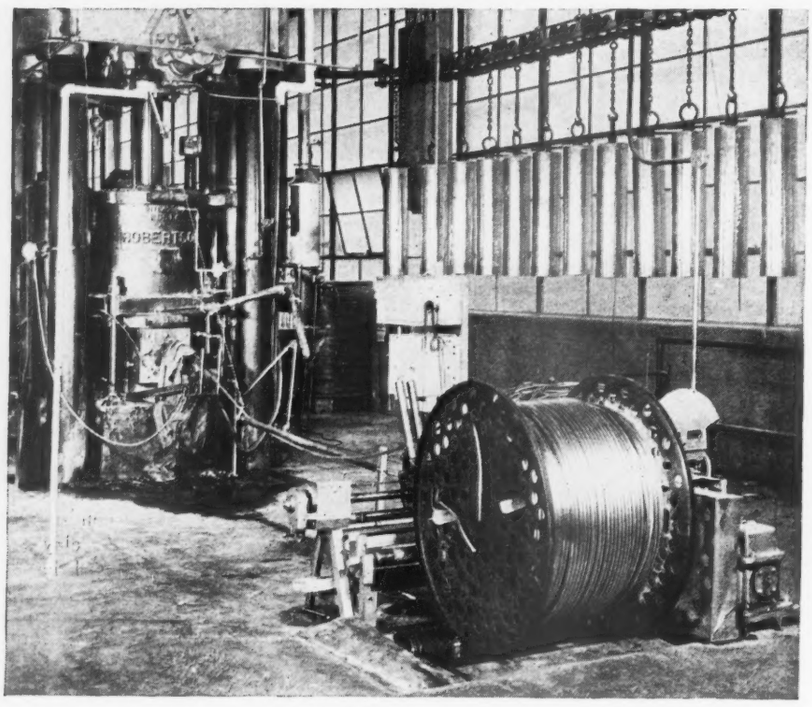
ELECTRICAL UTILIZATION

Mercury Switches Control Speed of Reel Motor

A. W. SIEWERT, *Plant Engineer*
The De Vilbiss Company, Toledo

When encasing air and fluid hose in a lead sheath preparatory to vulcanizing, a problem is presented in varying the speed of the take-up roll as the diameter of the lead-covered hose on the reel increases. An additional variable is the variation in the speed of the lead press, because the diameter of the lead sheath to be applied varies with the different sizes of hose.

To meet these changeable conditions, speed of the 2-hp., d.c. motor driving the reel is controlled by nineteen individual resistors in the field circuit. Each resistor is controlled by a mercury switch mounted on a shaft located in front of the resistors. These switches in turn are operated by a floating roll to which are attached nineteen semicircular cams.

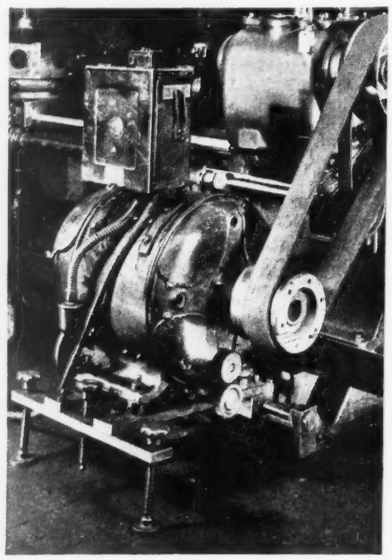


Pipe arm suspended between press and reel moves with the hose to operate switches

Between the press and the reel a pipe arm extends from one end of the box containing the switches out over the line of hose. To this arm is attached a sprocket bearing a chain which is weighted at the lower end. As the reel speeds up with increased diameter the tension on the hose increases. This raises the arm which in turn moves the sprocket on the floating roll and throws out some of the switches, thus reducing the speed of the motor.

If the reel motor runs too slowly the arm resting on the hose will drop toward the floor. This action causes the floating roll to throw in more switches and speed up the motor.

•



Special Base Prevents Slippage of Portable Motor

SYDNEY W. WATKINS
Electrical Engineer, The Warner & Swasey Company, Cleveland

Need for a convenient means of driving turret lathes for testing and adjustment after assembly led to development of the motor base shown in the illustration.

After the motor has been put in position and lined up, the sharp edge of the dog seen at the lower right-hand side of the base is driven into the floor. Its purpose, of course, is to prevent the base from being dragged forward when the belt is tightened. Another dog on the left-hand side is turned in the opposite direction, to counteract any tendency of the base to swing around under the pull of the belt.

Belt tension is adjusted by lowering the other side of the base by means of the long supporting screws which give wide range of adjustment.

How to Prevent Freeze-Ups in Fire Protection Equipment

Prepared by

ASSOCIATED FACTORY MUTUAL FIRE INSURANCE COMPANIES

COLD WEATHER BRINGS THE DANGER of freeze-ups in sprinkler piping, underground mains, gravity tanks, or fire-pump suctions, impairing fire protection equipment. This not only leaves the plant vulnerable to fire, but it may also involve expensive repairs for broken piping, and water escaping from burst piping may cause serious damage.

Ordinary precautions are usually adequate to protect against freezing, but sometimes prolonged periods of severe cold make it necessary to be particularly careful.

Experience shows that, as cold weather approaches, a careful check-up of the fire protection system should be made. The following precautions are based on experience and will help to avoid the worry, trouble, and damage that may result from freeze-ups.

Dry Sprinkler Systems

1. Make sure dry-pipe-valve inclosures are well insulated and adequately heated by electricity or steam.

2. Carefully inspect dry-pipe valves. Examine the interior of any valves that have not been tripped during the summer, to be sure that they are in good working condition. Set systems on air if they have been wet during the summer. Be absolutely sure that the controlling valve is left wide open.

3. Check the air pressure of pipe systems daily throughout the winter; also the temperature in dry-valve inclosures. Make sure the riser is not frozen below the floor.

4. Locate air compressor intakes where the air is cold and dry, not warm and moisture-laden as in dye rooms or similar locations. Moisture introduced with the air into dry-pipe systems condenses and collects at low points where it may freeze.

5. Check piping pitch to make sure there has been no building settlement resulting in low points where water will collect and freeze.

6. Check dry-pipe alarms to make sure they operate and will be heard. They give warning not only of fire but of accidental tripping of the valve, which would flood the system with water and might result in a complete freeze-up.

7. Throughout the winter, blow out all drains at low points in the air piping frequently to remove any water that may be in the system.

8. To test for air leaks, put one or two tablespoons of ether in the system and find location of leaks by odor of escaping ether. Avoid using too much ether, as ether-air mixtures are explosive. Put ether into compressor discharge rather than intake, as compressors may run hot.

Wet Sprinkler Systems

1. Provide adequate heating capacity to prevent freezing during the severest protracted cold that might reasonably be expected. Pay particular attention to attics, concealed spaces, underfloor spaces, entries, stair towers, shipping rooms, penthouses, and any out-of-the-way places. Search for isolated drafts or cold air leaks into any little-frequented areas or spaces where there are sprinkler pipes. Keep in mind the possibility of high winds during periods of low temperatures.

2. Repair windows and doors where necessary, and instruct watchmen to keep them tightly closed.

3. Inclose pipes exposed outdoors in heated weather-tight boxing.

4. Avoid shut-in-winter sprinkler systems wherever possible. Shut-off sprinklers afford poor protection; they are not automatic, and in the excitement of a fire, the valves are generally opened too late or not at all. Keep such systems under pressure at all times as far as practical. Make possible provision of heat either by installing air-check valves, which are essentially small dry-pipe valves, or by using non-freezing solutions. If sprinklers in small areas must be shut off for the winter, have controlling valves easily accessible and instruct watchmen and responsible employees to open them promptly in case of fire. Drain the pipes; leave drain valve slightly open.

Sprinkler Tanks

1. Make sure tank heaters and accessories—thermometers, pressure gages, valves, and regulators—are in good operating condition. Flush out circulating-type heaters and piping to remove sediment and scale. Renew seriously corroded pipes, using copper water tubing, brass pipe (85 per cent copper), wrought iron, or an iron alloy for the hot water pipes up to the tank. Make sure heater valves are open.

2. Make sure a good thermometer is placed in the return line from the tank. Maintain 42-50 degrees F. at the thermometer on the cold water return to circulating-type heaters. To test circulation, grasp the hot water

How to Prevent Freeze-Ups in Fire Protection Equipment

pipe in one hand and the cold water pipe in the other—an appreciable difference in temperature indicates good circulation. If steam is on and temperatures of both legs are similar, investigate further and ascertain whether ice has formed on the surface of the tank water. With radiator-type heaters in large steel-plate risers, maintain at least 50-60 degrees Fahrenheit.

3. Never overflow a tank to prevent freezing. Stop all tank leaks. Overflowing and leakage result in ice formation which overloads the tank structure, endangering life, property, and fire protection.

Mains, Hydrants, Indicator Posts

1. Inclose exposed mains, no matter how short, in heated boxing.

2. See that hydrants are tight and drain properly. Keep drains free, except in continuously wet soil, where drains should be plugged and the water pumped out of the hydrant barrel. Inspect hydrant barrels with a plumb bob or small weight to detect presence of water. Provide a 1½-in. plugged opening in monitor-nozzle risers for similar tests. Repair leaking indicator-post valves. See that fire department connections drain properly.

3. Keep hydrants and indicator posts unobstructed by snow. Remove waste material from mill yards.

Fire Extinguishers

1. In unheated buildings, provide extinguishers of the non-freezing type.

2. Fire pails in unheated locations can be made non-freezing with calcium chloride solution. For each gallon of solution add calcium chloride as specified in the following table:

Freezing Point Deg. F.	*Specific Gravity at 60 deg. F.*	*75% Calcium Chloride*		*80% Calcium*	*"Flake" Chloride*
		Water Gal.	*$CaCl_2$ Lb.*	*Water Gal.*	*$CaCl_2$ Lb.*
-10	1.211	0.843	3.07	0.865	2.88
-20	1.236	0.823	3.44	0.848	3.23
-30	1.257	0.803	3.78	0.831	3.55
-40	1.275	0.788	4.06	0.818	3.81

98% Fused Calcium Chloride can also be used but does not dissolve readily, except in hot water.

Fire Pumps

1. Keep pump rooms heated if necessary, paying particular attention to detached centrifugal pump houses.

2. Protect suction from freezing. If suction is taken from open water, make sure that the pipe and intake are located so that they will at all times be completely below frost level underground, and deep enough in the water to prevent their being obstructed by ice.

Winter Fire Hazards

1. Overhaul heating boilers and clean out soot from flues.

2. Remove combustibles from vicinity of steam pipes or heaters. If necessary to force tank heaters, keep them under careful supervision to prevent fires from starting; or preferably install heaters of greater capacity.

3. Do not use open flames or torches for thawing frozen water pipes near combustible construction or materials.

Extra Precautions During Extreme Cold Spells

1. Maintain extra heat if necessary to keep the sprinkler piping from freezing. Check the heating system to make sure it is delivering heat to all areas, utilize its full capacity if necessary, and keep more steam on at night than is customarily the practice.

2. Check the safeguards outlined above. Look particularly for places where cold winds can blow in, closing up even small openings, and keeping all doors, especially large shipping doors, tightly closed at all times except when they must be opened.

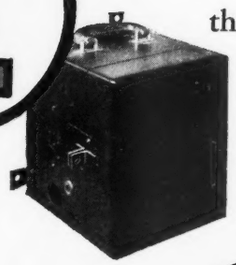
3. Check room temperatures frequently, especially if they get near freezing. If freezing of the sprinkler system seems practically certain, even if all available heat is being provided, shut off the system and drain the pipes. Then take extra precautions by laying hose and having it ready for immediate use in case of fire, and also have extra watchmen patrol the shut-off areas. Restore protection as soon as the danger of freezing is past, and provide greater heating capacity to prevent a recurrence, as it is very undesirable to shut off protection even temporarily.

4. After a prolonged period of abnormally cold weather, make drain tests of sprinkler risers wherever practicable to determine whether underground mains are frozen. Open the drain wide, let it run half a minute or more, and then shut it off. If the pressure fails to return promptly to normal, restore protection as soon as possible.

5. If sprinkler piping, underground mains, or tanks are found frozen, notify your insurance company by wire, stating what buildings are without protection and what steps are being taken to restore protection.

THE EXIDE SYSTEM SPEEDS UP MATERIAL HANDLING IN FOUR DEFINITE WAYS....

1



Your battery electric trucks will move more materials, move them faster, more efficiently, dependably and economically with the help of the Exide System.

Special Exide instruments determine scientifically the type and size of Exide-Ironclad Battery best meeting your particular requirements. You are sure of the right battery.

2

You get an Exide-Ironclad, a powerful, dependable and long lasting battery.

3

To insure maximum truck performance while eliminating the danger of "tow-ins" and delays, Exide supplies the Exide Discharge Indicator, which mounts on the truck and flashes a warning light as the battery nears the discharge point.

4

To save time and trouble, and to insure the most efficient battery maintenance, the Exide Charge Control Unit, which mounts on your charging panel, automatically controls the rate of charge, cutting the circuit and signaling when the charge is complete. Why not write for full details today?

Exide
IRONCLAD
BATTERIES
With Exide **MIPOR** Separators
"MIPOR," Reg. U. S. Pat. Off.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

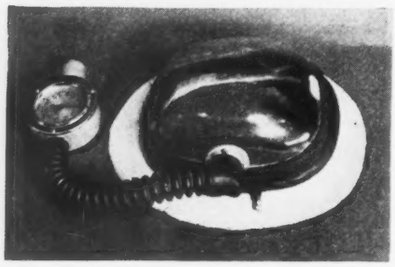
You Want to Know

more about the items mentioned on this page.
Letters to the addresses given will bring information

• RUBBER MATTING, called "Ezykleen" because its round-surface ribs lend themselves to fast, easy cleaning, comes in six colors, two thicknesses, two widths. The B. F. Goodrich Co., Akron.

• SOLVENT, a semi-paste, removes finishes of the synthetic resin type, paint, varnish, enamel, shellac, and lacquer. "Strypeeze" is flowed on with a brush, is said to be harmless to the surface stripped, and the hands and clothing as well. The Savogran Co., India Wharf, Boston.

• FLASHLIGHT can be submerged in water indefinitely without affecting its operation. Vaporproof also, it can be used in explosive atmospheres. There's a focusing lens. Stewart R. Browne Mfg. Co., 258 Broadway, New York.



NOT A GAS MASK or an air-conditioned helmet, but a transparent rubber-sealed "lung" for inducing artificial respiration, and therefore a piece of plant first-aid equipment for resuscitating victims of electric shock and asphyxiation. Operated by electric or manual pump, it fits over the chest, can be used without removing clothes. General Tire & Rubber Co., Akron

• SEALING COMPOUND of synthetic plastic, applicable by hand, gun, or putty knife, is said to be waterproof and weatherproof, non-sagging and non-crumbling. It finds use in glazing, duct sealing, on floors and pavements, and in general building maintenance. Firmex Plastic Co., 104 Nineteenth St., Brooklyn, N. Y.

• SOLDERING IRON, small as a pencil, for fine or close work, consists of an electric soldering iron fitted with a bracket to hold it on the bench, and a pencil-size iron inserted in place of the regular tip. Electric Soldering Iron Co., Inc., Deep River, Conn.

• EASY TO ERECT are partition walls of fireproof asbestos-cement material for subdividing offices and plant departments. Furnished in large, light-weight panels, dismantling and relocating them is just as easy. Johns-Manville, 22 East 40th St., New York.

• MAGNET WIRE combines good electrical and chemical properties with a tough, flexible insulating covering of synthetic resins that is said to stand up under high-speed winding, assembly, and varnishing. General Electric Co., Schenectady, N. Y.

• NOISE ANALYZER detects flaws in running machinery, and foreign materials in packaged products, by measuring the intensity of sound at any preselected pitch. No longer will it be necessary to depend on the operator's or inspector's ear to detect a faulty motor or a lead solder pellet in a food can—a dial shows up defective pieces. Electrical Research Products, Inc., 195 Broadway, New York.

• PACKAGING INFORMATION contained in three booklets, "Improved Methods in Packing and Shipping" (75c.), "Recent Developments in Packaging Progress" (50c.), and "Problems Under Informative Labeling" (50c.), can be had from the American Management Association, 330 West 42d St., New York.

• METAL AWNINGS, Venetian type, afford year-round sun protection and ventilation, and are said to lighten load on air conditioning systems by reducing concentration of heat around window openings. F. C. Russel Co., Cleveland.

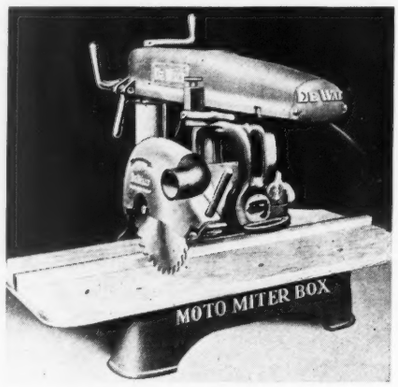
• LITTLE FIRES haven't much chance to become big ones when a fire detection system, consisting of detector heads located where fires are apt to start, a gong, and power connection, is installed. Technical Appliance Corp., 17 East 16th St., New York.

• MACHINE TOOL APPLIANCE, known as an "Adjustable Micro-Nut," provides a means of quickly setting end-cutting tools to the correct length. Graduated for adjustments ranging from 0.001 to 0.020 in., it comes in all sizes of standard adjustable adapters. The Gairing Tool Co., Detroit.

• LETTERING SET for draftsmen produces eight different types of lettering in 48 weights, simply by changing setting of tracer and pen arm, and weight of pen point. Has upper and lower case letters, numerals, and characters. Eugene Dietzgen Co., 2425 Sheffield Ave., Chicago.

• LEATHER BELT WIDTHS for specific conditions and installations can be quickly figured on a handy slide-rule calculator. J. E. Rhoads & Sons, 35 North 6th St., Philadelphia.

• PORCELAIN-ENAMELED ROOF is the latest. Corrugated-steel roofing whose parts "lock" together to eliminate exposed bolt holes and heads is enameled to protect it against weathering and corrosion. Stack, gables, trim, gutters, window-sash, and doors have been treated in the same way. Ferro Enamel Corp., East 56th St., Cleveland.



MOTORIZED MITER BOX is practically a woodworking shop in itself, for it performs 29 different operations. Arm swings 360 degrees horizontally for miters, yoke swivels 360 degrees horizontally for changeover from cutoff to rip position, and motor rotates 360 degrees vertically for angle cuts. Runs from lighting circuit. DeWalt Products Corp., Lancaster, Pa.

• CHAIRS AND TABLES, all-metal, for cafeterias, rest, and social rooms, feature a space-saving design that permits their being compactly stacked when room must be cleared. All-welded, steel tubing construction. Designed by Thomas E. Smith and manufactured by Swan Engineering Co., Inc., 410 Frelinghuysen Ave., Newark, N. J.

• TECHNICAL INFORMATION on measurement and analysis of noise and vibration, and on fluid flow measurement by head-type metering elements, is contained in two booklets offered at 50c. each by The Instruments Publishing Co., 1117 Wolfendale St., Pittsburgh.

• X-RAY SERVICE offers economical means of making photographic records of employee health, without taking time off from work. Portable equipment is brought to the plant to make lung x-rays for employee health campaigns or to meet insurance company requirements. Precision Radiographs, 39 South La Salle St., Chicago, and Powers X-Ray Products, Inc., 205 West 39th St., New York.

How to do it?

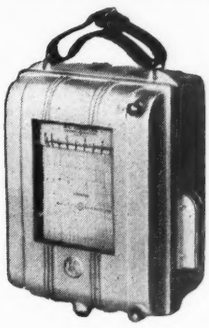
For savings in plant operation, be sure to consider these G-E developments

NEW MAGNETIC MOTOR STARTER

Here's a new, Size 0 magnetic starter for motors up to two horsepower that is as small as many manual starters. Yet it includes (1) a push button, (2) isothermic overload protection, (3) undervoltage protection—all the advantages of a larger magnetic starter. Bulletin GEA-3250 contains complete information, and we'll be glad to send you a copy.

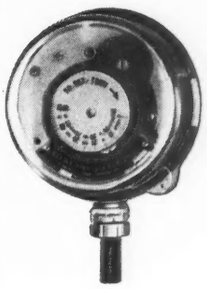
VIBRATION-VELOCITY EQUIPMENT

To measure building vibration caused by generators as well as excessive vibration of machinery, here's a portable, general-purpose, wide-range instrument. It measures vibration of large or small bodies in a single direction throughout any angle from horizontal to vertical. It's simple, lightweight, easy to use. Write us for details.



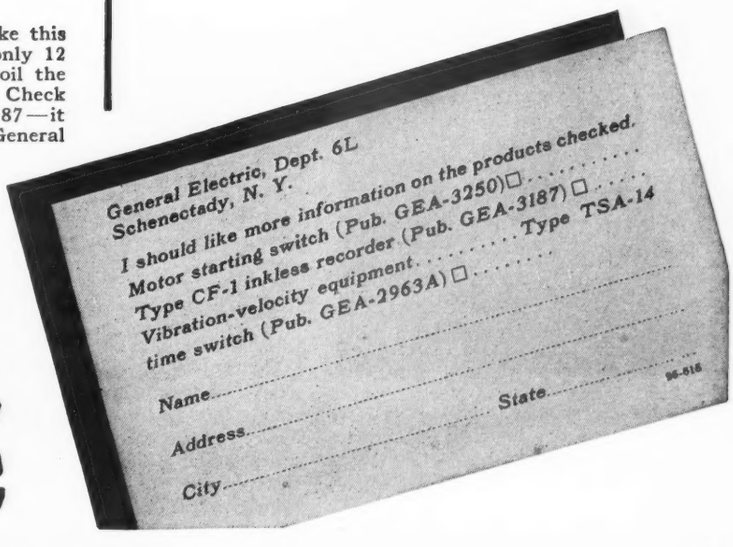
NEW INKLESS RECORDER FOR SURVEY WORK

You've never seen a recording instrument quite like this Type CF-1, for it's portable, inkless, and weighs only 12 pounds. There's no ink to freeze or spill or to spoil the record. And it's equally applicable indoors or out. Check the coupon for a copy of Publication GEA-3187—it contains full information on this recent addition to General Electric's complete line of electric instruments.



A PROCESS TIMER FOR UNIFORM QUALITY

You spend a lot of time planning your processes to assure uniform quality products, and here's a time switch that will be a real help when it comes to maintaining accurate processing schedules. It's a "cinch" to put a Type TSA-14 switch on any machine in your plant—no fancy installation. Find out more about this short-cycle, automatic, repeating timer by using the coupon. Check Bulletin GEA-2963A.



GENERAL ELECTRIC

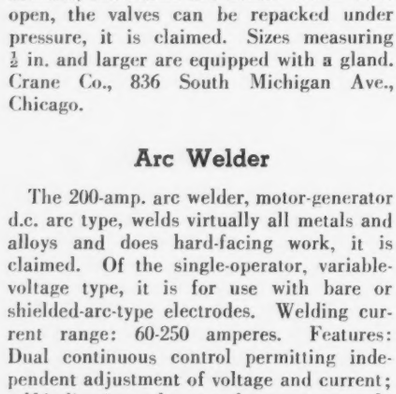
What's New in Equipment

Gate Valves

Line of 200-lb. brass gate valves, made with wedge disks and rising stems, are available in 2 models, sizes ranging from ¼ to 3 inches. No. 422 has seats cast integral with the body; No. 423 has renewable body-seat rings. They are for service on steam, water, oil, or gas lines. Sizes measuring 2 in. and under have a union bonnet. The 2½- and 3-in. sizes have an inside screw bolted bonnet equipped with steel studs, brass nuts, and gasket. The renewable body-seat rings and wedge-type disks are made of nickel alloy. Bodies, bonnets, and stems are brass. When wide open, the valves can be repacked under pressure, it is claimed. Sizes measuring ½ in. and larger are equipped with a gland. Crane Co., 836 South Michigan Ave., Chicago.

Arc Welder

The 200-amp. arc welder, motor-generator d.c. arc type, welds virtually all metals and alloys and does hard-facing work, it is claimed. Of the single-operator, variable-voltage type, it is for use with bare or shielded-arc-type electrodes. Welding current range: 60-250 amperes. Features: Dual continuous control permitting independent adjustment of voltage and current; self-indicating voltage and current control; Class B insulation containing no inflammable material and enabling welder to withstand sustained overloads; "Linc-weld" motor of squirrel-cage induction type for



across-the-line starting. Connections for 220 or 440 volts (also supplied for 550 volts or special voltage), 3 or 2 phase, 60 cycles. The Lincoln Electric Co., 12818 Coit Road, Cleveland.

Lighting

"Controlens" lighting unit features "built-in" lighting without metal housing. Consists of a 13½-inch-diameter crystal glass lens of the sectored plano-convex type; a crystal glass reflector 7 3/16 in. deep and 13½ in. in diameter held by metal lugs; spun metal fitter slotted to provide ventilation and fitted to the reflector neck by 4 set screws; a 200- or 300-watt lamp; cast-iron supporting ring and faceplate 15½ in. in diameter. Installation: Plaster ring is set in position in the ceiling; flexible wiring from outlet box is brought to socket in the fitter attached to neck of reflector which is then rested on the plaster ring; faceplate is attached by hinge to the plaster ring; and the lens is fastened to the faceplate which is then screwed in to the plaster ring. Holophane Co., Inc., 342 Madison Ave., New York.

Mercury Switches

Delayed-action mercury switches are available with time-delay intervals of ½ to 15 sec. in the circuit-opening type, and ½ to 10 sec. in the circuit-closing type. They may be operated by means of a lever or cam action, or by means of a solenoid. Their electrical capacity is designed for handling the average control circuit. Hermetically sealed in glass, the switches are adapted to use in moist or corrosive atmospheres. Lamp Department of the General Electric Co., Hoboken, N. J.

Fork Trucks

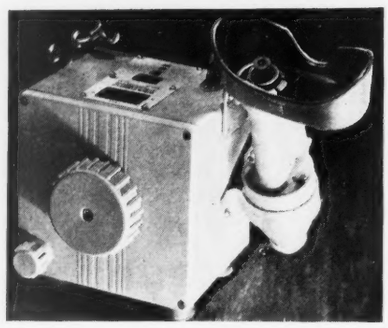
Line of center-control fork trucks, capacities from 2,000-7,000 lb., is available in tilting or non-tilting, telescoping or non-telescoping models. Lifting system comprises a gear pump driven by a standard Baker motor, a release valve, a jack cylinder. Tilting and lifting systems are operated by same motor and pump but with separate control and valve. In telescoping models a total fork lift of 126 in. is available with standard over-all height of 88 inches. The forks lift 24½ in. before inner telescoping uprights start to move—important where overhead clearance is limited. Steering axle is located in rear. On trucks of 4,000 lb. capacity and over, hydraulic wheel brakes are provided on drive wheels. On the smaller trucks, travel brake is on driving motor shaft. The Baker-Raulang Co., 2168 West 25th St., Cleveland.

Pump

Tubing in a new pump, for handling chemicals, foodstuffs, and corrosive and abrasive liquids, is of rubber or neoprene and is incased to prevent expansion beyond normal diameter and length even under high pressures. An eccentric rotor revolving within a circular compressor ring exerts pressure on the tubing progressively from the intake to the discharge end to squeeze out the liquid drawn in by the vacuum action of the pump. The ring closes the tubing forced against it by the rotor. When released, the tubing springs back into shape. No stuffing box is used. Valves on the suction side are eliminated as the expansion of the empty tube creates instant vacuum, it is claimed. Where the liquids carried react too severely on the rubber tubing, neoprene is used. Huber Pump Co., 90 West St., New York.

Pyrometer

Potentiometer-type optical pyrometer employs a "disappearing filament" which,



when the operator's telescope is focused on the incandescent object whose temperature is to be measured, appears as either a light or dark line. In taking a reading, the operator adjusts filament brightness to equal that of the object by turning knob that changes filament current. By turning a second knob, he balances the potentiometer which is used to measure filament current, and which is calibrated directly in temperature degrees. For temperatures from 1,400–2,250 deg. F., filament and object are compared directly. For higher temperatures the operator turns a ring at the front of the telescope thus introducing an absorption screen between filament and object reducing object brightness and rendering the instrument direct-reading on a higher-range scale. Standard ranges are from 1,400–5,200 deg. F. Both potentiometer and telescope are housed in light-weight

TEXROPE DRIVE "GOING STRONG!"

AFTER 10 YEARS ON THE JOB!

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

250-HP Texrope Drive Turns 60-Ton Tube Mill in Large Midwestern Quarry . . . Goes Ten Years Without Maintenance Costs! Find Out How YOU Can Cut Transmission Costs with Texrope Drives!

Crushing rock is no easy job! Because it's a low-priced commodity, rock pulverization has to be done at lowest possible cost . . . with equipment (especially transmission equipment) that has wide safety margins and extremely low maintenance!

At the Waukesha Lime & Stone Company, they have a 250-hp Texrope Drive on a 60-ton tube mill that has been giving rock-bottom transmission costs for over ten years!

Profit with Texrope!

Now, after ten years, here's its story: — the same original seventeen belts on this Texrope Drive are still in use . . . still handling the torque strain of turning 60 tons from a dead stop. Not one cent has been spent on this mill for transmission maintenance in all that time. And C. G. Wolf, assistant superintendent, states his Texrope Drive is "still going strong!"

Whatever your problem, these are interesting facts . . . especially if you are looking for a money-saving solution to a tough transmission job.

It will pay you to get the full Texrope Drive story—about the new, special, cool-running rubber compound that means even longer belt life than before . . . the scientific matching of belts into "sets" for equal pulling and wear . . . the "wedge" construction for highest operating efficiencies (up to 98.9%).

TEN YEARS ON THE JOB AND STILL good for a long time — that's the history of this 250-hp Texrope Drive. C. G. Wolf, assistant superintendent at Waukesha Lime & Stone Co., Waukesha, Wisconsin, examines the drive and reports — "Still going strong!"

For all industrial transmission needs between ¼ hp and 2,000 hp, call the Allis-Chalmers district office or representative near you. Or write to Allis-Chalmers, Milwaukee, Wisconsin.

A-1160

Vari-Pitch Speed Changers • Texrope V-Belts • Duro-Brace Texsteel Sheaves • Vari-Pitch Sheaves • Standard Cast Iron Sheaves • Adjustable Pitch Diameter Texsteel Sheaves • 2-3-4 Combination Sheaves • Straitline Automatic Motor Bases • Oil Field Drilling Rigs

Belts by Goodrich

TEXROPE DIVISION

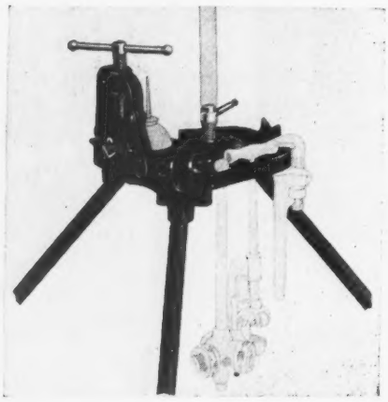
ALLIS-CHALMERS

MILWAUKEE·WISCONSIN

alloy castings, and telescope eyeshield is flexible and non-heating. Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia.

Vise and Stand

"Tri-Stand" vise with 3-legged stand is constructed to prevent tipping. Legs are hinged at the tray and fold together and fasten with a chain for carrying. They are



equipped for screwing to plank or floor if desired. Tray has space for dope pot, oil can, and tools which can be hung on the raised rim as well as in slots provided in the tray. Other features include a pipe rest and 3 different size pipe benders that won't collapse the pipe, and an adjustable screw for ceiling brace to hold vise rigid while in use. Available in 2½-in. yoke and 4-in. chain patterns. The Ridge Tool Co., Elyria, Ohio.

Arc-Welding Electrode

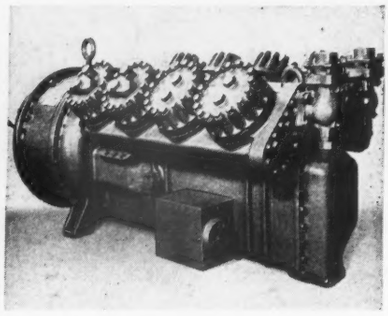
"Fleetweld 10" arc-welding electrode that is said to facilitate finishing operations on welded products by eliminating need of dressing or smoothing welded seams, is for finish-bead welding on U-groove welding in downhand position. It is said that the weld provides full slag coverage; the bead is uniform and regular without square shoulders; the metal smooths out evenly during welding; the line of fusion with the base metal is practically invisible; and finish beads can be made in V-butt joints in flat position flush with the surface of the plates. "Fleetweld 10" can be used with normal or reverse polarity with d.c. or a.c. Universal motor operates on a.c. or d.c. Available in 2 sizes: 18-in. lengths, ¼- and 5/16-inch. The Lincoln Electric Co., 12818 Coit Road, Cleveland.

Reset Counter

Instantaneous reset counter, relay for limiting number of operations of a machine or part in a processing cycle, is adapted for use in control circuits of automatic machine tools and process controls in which a contact is to be closed for a predetermined number of operations. The counter is automatic in operation; e.g., a limit switch attached to a machine sends an impulse to the counter upon each revolution of the shaft. Upon reaching the predetermined number of impulses, the motor is shut down. Dial settings remain fixed until the operator changes them. Operation is controlled by 2 switches (control and impulse types) or contacts usually located on device being controlled. Type of switch used depends upon application made of counter. Standard counters have compound dial with counting range of 0 to 400 in steps of one. Inner dial is calibrated in steps of 1 from 0 to 20; outer dial in units of 20 from 0 to 400. Each revolution of inner dial advances outer ring 1 unit division. Setting is the sum of the 2 readings. Available in standard commercial voltages and frequencies. Eagle Signal Corp., Moline, Ill.

Elastic Stop Nuts

In addition to the standard line of self-locking nuts, elastic stop nuts are now available in any combination of style, size, and thread system. They incorporate a resilient non-metallic collar which, it is claimed, takes up thread play and thus establishes a constant thread contact which holds the nut in position on the bolt regardless of vibration or wear of surrounding parts. Elastic Stop Nut Corp., 1015 Newark Ave., Elizabeth, N. J.



Air-Conditioning Compressor

Hermetically sealed, 100-ton, 16-cylinder, V-type compressor features sealed-in lubrication, reversible oil pump, and refrigerant cooling for the motor. Use of cold refrigerant gas returning from the evaporator to cool the driving motor, has made possible reduction of size of motor and elimination of external ventilation. Direct-drive motor and compressor have a common crankshaft. Hermetic sealing eliminates shaft-seal. In servicing, removal of side plates from crankcase exposes operating mechanism. Pipes need not be disconnected. Available for use on 2- or 3-phase, 60-cycle circuits for 208, 220, or 440 volts. Standard magnetic across-the-line starters or step-type starters may be used. Weight, 4,200 lb.; length, 7 ft. 6 in.; width, 2 ft. 10 in.; height, 3 feet. Westinghouse Electric & Mfg. Co., East Pittsburgh.

Machine-Tool Lighting Units

Transformer units, for providing light on machines equipped with individual motor drive, are furnished to operate on any power-line voltage from 220-575, and provide a 115-volt lighting circuit. Standard models are for use on 50- and 60-cycle lines. The unit can be mounted on the motor-switch box or on the machine. It consists of a fully inclosed high power factor transformer mounted in a standard sheet steel box, provided with a fuse block and 1 flush receptacle on the 75-watt unit, or 2 receptacles on the 150-watt unit. Available in units up to 600 watts output capacity; also in output voltages of 32, 12, or 6. Weight 15 lb. (75-watt unit), 19 lb. (150-watt unit). Cole Radio Works, Caldwell, N. J.

Utility Truck

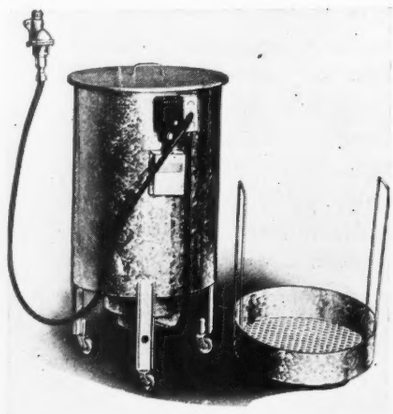
Redesigned utility truck features roller-bearing-type casters and all-electric arc-welded construction except for attachment of handle which is bolted. Two 4-in. stationary casters and one 3-in. swivel caster are used. They may be equipped with semi-steel or rubber-tired wheels. Adapted for handling baskets, tote boxes, crates. Platform measures 22x32½ in. (36 in. to end of nose) and stands 5 in. high; handle is 30 in. above floor; weight—100 pounds. Lyon Iron Works, Greene, N. Y.

Diffuser

"Protecto" diffuser, pendant or outlet-box mounting, is for illuminating areas where precision operations are conducted. To eliminate glare of protruding globes, it uses a porcelain-enameled deep-skirted reflector and a globe concealed above the bottom of the reflector skirt. A portion of the light is directed to the ceiling through apertures near the top of the reflector. A "Diskonect" hood permits release of reflector, globe, and lamp as a complete unit without use of tools and without disturbing wires, it is claimed. A "Hevy-duty" threaded hood finished in white porcelain enamel is also available. Goodrich Electric Co., 2900 North Oakley Ave., Chicago.

Degreaser

Model 110 degreaser operates on 110 volts, a.c. One and one-half gal. of solvent, generated into a vapor in a generating tank in the bottom of the machine, is said to clean from 1–3 tons of work. Parts to be degreased are placed in a basket within the cleaning tank where the hot vapor condensing on the parts removes grease and oil. Model 220, operating on 220 volts a.c.,



SERVING AND SAVING
YEAR AFTER YEAR

DARNELL CASTERS AND E-Z ROLL WHEELS

are Hyatt equipped for extra long life and satisfactory service. Darnell Corporation Ltd., Long Beach, California, are the manufacturers.

Year after year, you witness the widespread application of Hyatt Roller Bearings to material handling equipment. In trucks, cranes, trolleys, hoists, tractors, conveyors . . . everywhere these better bearings are serving and saving.

Most manufacturers use Hyatt Roller Bearings as regular equipment; others on specification. Make sure you get Hyatts and the many advantages they bring. Hyatt Bearings Division, General Motors Sales Corporation, Harrison, New Jersey; Pittsburgh, Chicago, Detroit, San Francisco.

HYATT *Roller* BEARINGS

has 4-gal. solvent capacity cleaning 3–6 tons of metal. The machines are designed to reclaim and distill the solvent for repeated use. Vapor level is maintained within the tank electrically. A flusher flushes off sand and road dirt from engine and other parts. Tumbler model tumbles parts while degreasing. Available on order for d.c. operation. Phillips Mfg. Co., 346 West Huron St., Chicago.

Electric Arc Welder

Handwheel on tip of motor-generator arc welder provides single-operator control permitting operator to obtain an infinite number of current settings, it is claimed. Provision against accidental reversal of polarity is made through a double-pole, double-throw snap switch on top of the machine that must be flicked to change polarity. Built as a 2-bearing unit with motor rotor

and generator armature mounted on a common shaft. Propeller blades attached to shaft provide ventilation by drawing air in at both ends and expelling it down the center. Both stationary and portable machines are mounted on welded steel bases. Three sizes: 200, 300, and 400 amperes. Speed rated at 1,800 r.p.m. on 60 cycles or d.c.; 1,500 r.p.m. on 50 and 25 cycles. Wilson Welder and Metals Co., Inc., 60 East 42d St., New York.

Fluorescent Lighting Unit

HF-100 lighting unit, complete with two 40-watt, 48-in. fluorescent lamps, plugs into a 60-cycle a.c. socket. It is 57 in. long, 9 in. wide, 7 in. high. It is said to be corrected for power factor and to have stroboscopic effect practically eliminated. Available in 2 types: for operation on 115 volts and on 230 volts. Hygrade Sylvania Corp., Salem, Mass.

Waterproof Transformer

Portable transformer, for use in wet or damp places, is designed to protect user from electric shock when working on wet floors, metal floors, and inside metal tanks. The transformer plugs into a 110-volt circuit to service a standard 32-volt 50-watt lamp. It can also be supplied to deliver 12 or 6 volts, and is for use on a.c. at 50 or 60 cycles. It is said to be electrically insulated from the 110-volt circuit and not "grounded." The cast-iron case is fitted with a rigid handle, a removable cast-iron gasket-fitted cover at the bottom, waterproof fittings for the cords. Cole Radio Works, Caldwell, N. J.

Drill

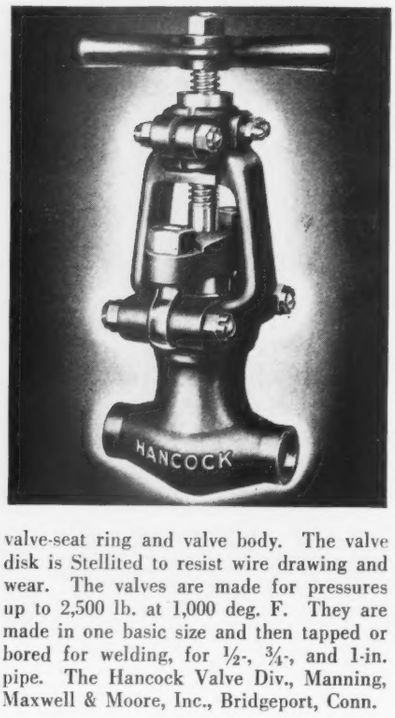
No. 89 lightweight drill, having ½-in. capacity, has a high-torque motor with operating speed rated at 500 r.p.m. Features claimed include self-aligning oilless bearings, air-cooled die-cast case, direct-thrust handle, removable side handle for work in narrow spaces, thumb switch. SpeedWay Mfg. Co., 1869 South 52d Ave., Cicero, Ill.

Pneumatic Grinder

Thor "Bantam" rotary air grinder, for small-wheel work, is 5½ in. long and weighs 18 ounces. It is said to be capable of operation at a free speed of 14,000 r.p.m. It can be used with abrasive wheels up to 1½ in. in diameter, with rotary files, steel cutters, sanding disks, wire brushes, saw blades, buffing and polishing wheels. Push-button throttle may be locked for continuous operation. Lever throttle may be supplied in place of the push-button throttle. Standard equipment includes a ¼-in. collet and swivel hose connection. Adaptor for collet may be replaced by an adaptor with chuck. Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago.

Valve

Valve, designed without bonnet joint to end leakage through gasket joint between valve body and bonnet at elevated pressures and temperature, finds use particularly in the oil, chemical, and other industries handling explosive fluids. When the valve is welded in the line, the only joint, it is claimed, is that of the stuffing box for the stem. Stellite seat is welded to the valve body thus eliminating threads between the



valve-seat ring and valve body. The valve disk is Stellited to resist wire drawing and wear. The valves are made for pressures up to 2,500 lb. at 1,000 deg. F. They are made in one basic size and then tapped or bored for welding, for ½-, ¾-, and 1-in. pipe. The Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Power-Scoop Truck

Power-scoop truck, in which 3 separate motors are applied to the traveling operations, to the scooping mechanism, to elevating and lowering the scoop and load, is

designed to handle loose materials. The scoop has a ½- to 1-yd. capacity and is capable of being rotated more than 100 degrees. Power plant may be electric or gas-electric. The motors, together with gear reductions and controllers, are built into the truck and are provided with slip clutches and limit switches. Limiting device controls elevating and lowering of load. Electric brakes supplement mechanical foot brakes in operation on ramps. Has regenerative load-lowering mechanism for returning power to battery. The Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland.

Air Circuit Breaker

Air circuit breaker, claimed to be ½ the size of previous devices of the same rating, has a De-ion arc chamber which operates on a.c. or d.c. It is said to operate on any current within range of established interrupting ratings, and to have an arcing current limited to ½ cycle. No carbon is used in the breaker contacts, it is said. Moving core of solenoid mechanism is connected to the breaker operating level. The breakers are adjustable to front-of-board, drawout, back-of-board, and separate inclosure mounting. Five sizes cover range of operating currents from 15 to 6,000 amp. at 600 volts a.c.—15 to 10,000 amp. d.c.—and have interrupting capacities of 40,000-80,000 amperes. Westinghouse Electric & Mfg. Co., East Pittsburgh.

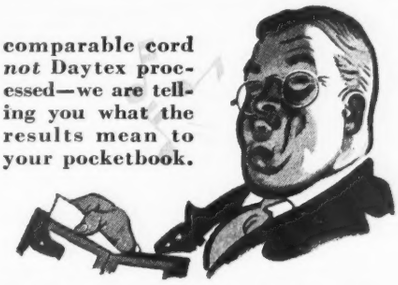
Drum, Barrel, Can Carriers

Carriers handle such open- and closed-top drums and half-drums (55-gal. capacity) as lubricating, ash, and garbage cans; wood and chimeless steel barrels; steel drums. The load will not tilt, spill, or slip, nor will the carrier distort or break, it is claimed. The barrel is lifted and locked to the carrier for transportation by inserting the lifting wedge under the barrel, slipping the extension grip over the top rim, and pushing the handle down 8 inches. A band-lock attachment, which goes around the top of the drum, is provided for use in handling drums made of light-gage material to prevent the ma-

YOUR WAIST MEASUREMENT may be your personal affair but your business *waste*-line is ours.

Our job of reducing your production costs began with the seven years of tireless research which our technical laboratories spent in developing Dayton V-Belts with Daytex Cord in their neutral axis section.

Right now—instead of telling you about the exhaustive laboratory tests which proved beyond question that Daytex Cord has less stretch, longer life and greater strength than the best comparable cord *not* Daytex processed—we are telling you what the results mean to your pocketbook.



Field applications, under all conditions, in all types of industries, in all climates and places, prove beyond question that Dayton V-Belts with Daytex Cord are cooler running and stand up under constant high speed flexing to give you greater pulling power at less cost per day, per month or per year.

Dayton V-Belts are outstanding in basic design because they are built to bend with patented cog construction. They work on short centers and save space. They reduce adjustments to a negligible minimum. They increase output, they reduce expense, maintain machine speed and prevent power waste.

In other words Dayton V-Belts with Daytex Cord save your time, your money and your machinery. Get all the facts from your local Dayton distributor. Ask him for catalogs, data and "The Picture Story of Daytex Cord."

THE DAYTON RUBBER MANUFACTURING CO.
DAYTON, OHIO

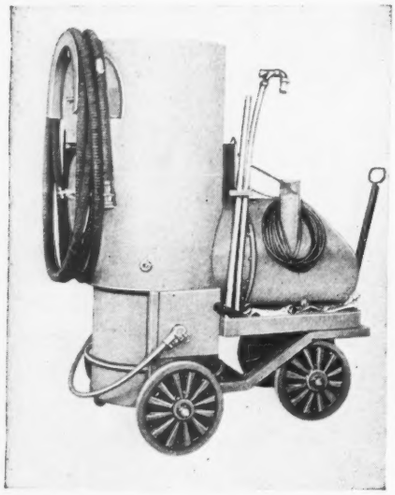
terial from giving and the contents from spilling. Charles K. Ernst, Inc., 999-1007 East Ferry St., Buffalo.

Electric Time Switches

Time switches, for automatic control of electrical circuits for timed operations, are housed in steel cabinets with concentric knockouts in top, bottom, back, and sides. The make and break switch action is mechanically operated by motor-driven clock movement and produces a "wipe-action" before contact is broken. Some advantages claimed include protection against sticking contacts; contacts kept in clean operating condition; greater contact life. Available in single-circuit, single- or double-pole, single-throw, 60-cycle models; and in 2-circuit, single-pole, single-throw, 60-cycle models. Single-circuit models have either a 1-hr. or a 24-hr. dial. Two-circuit models may have two dials—either one 1-hr. and one 24-hr., or two 1-hr., or two 24-hr. The Wadsworth Electric Mfg. Co., Inc., Covington, Ky.

Vacuum Cleaner

Portable vacuum cleaner, with dust capacity of 5 to 7½ ft., has a dirt container



mounted on casters. When pushed into place, self-locating guards hold it until the bar is drawn down raising the container from the floor to seal it against the rubber gasket. The vacuum producer has a direct-connected motor rated at 3,450 r.p.m. with impellers mounted directly on the motor shaft thus eliminating the belt drive. Features include a separator having seven 8-in. tubular bags with a total filter area of 39 sq. in. held in place by a spring steel ring; hand shaker inside tank; 2 inspection doors in front of separator providing access for bag inspection or replacement; cleaner mounted on four 18-in. wheels. The Spencer Turbine Co., Hartford, Conn.

Welder

A.C. electric welder, Model E2F, for operation on 220 or 440 volts, has a continuous rating of 500 amperes. It can be operated by two men simultaneously from 30-280 amp.; by one man, by shifting a bar on top of the welder, from 30-560 amp., it is claimed. Electrodes from $\frac{1}{16}$- to ½-in. diameter can be used. Welding range is controlled by 2 rotary switches—40 welding heats covering the entire range. Measures 20x26x35 in.; weighs 460 lb.; is mounted on ball-bearing casters. Hampton Electric Tool Co., 700 Walnut St., Edgewood, Pittsburgh.

Flow Indicator

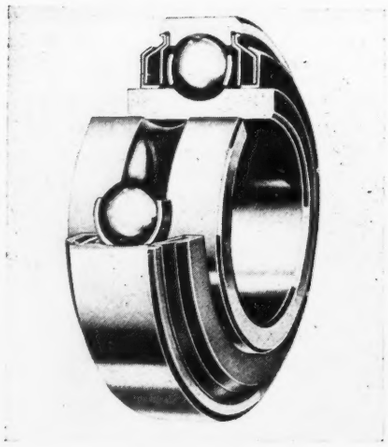
The MJL No. 98 rate-of-flow indicator, differential-pressure type, is for indicating the flow of liquids, steam, and gases; for balancing flows; for indicating rate of flow of cooling water and lubricating oils to bearings, cooling water to condensers and electrical transformers, and water to filters and softeners; and for indicating liquid levels in boilers and tanks whether under pressure or not. As a flow indicator, the instrument is actuated by differential pressure produced by an orifice, venturi tube, or pitot tube inserted in the pipe line. The pressure differential is balanced by a calibrated bellows unit which moves in direct relation to the pressure applied. This movement is transmitted to a pointer moving over a scale of any units desired. The indicator need not be accurately leveled, it is claimed, and may be calibrated for any differential pressure range between 0-30 and 0-225 in. of water. Morey & Jones Ltd., Rm. 925, 922 South Hemlock St., Los Angeles.

Dust-Proof Lighting Fixture

Dust-proof fixture, for use where combustible dust is suspended in the air in quantities sufficient to produce explosive mixtures, and where fibers and materials producing combustible particles are handled, may also be used where dust collects on fixtures in a quantity apt to cause overheating. Available with a threaded clear glass globe and heat-resisting daylight blue, ruby, or diffusing globes, with or without a one-piece copper hood, it accommodates lamp sizes from 25-150 watts and is fitted with a removable resilient socket. Goodrich Electric Co., 2900 North Oakley Ave., Chicago.

Chemical Cartridges

Three chemical cartridges that can be interchanged with the standard Type A dust cartridge now supplied for the American R1000 respirator are available. One is for use against light organic vapors and low concentrations of fumes and gases encountered in paint spraying. When used in paint spraying, a protective cover can be supplied to retard plugging. The second is for use against low concentrations of acid gases; the third against low concentrations of acid organic gases. Alike in construction, the cartridges differ in the filtering element. Separator on inlet side is said to permit full use of the entire absorption medium. American Optical Co., Southbridge, Mass.



Ball-Bearing Seal

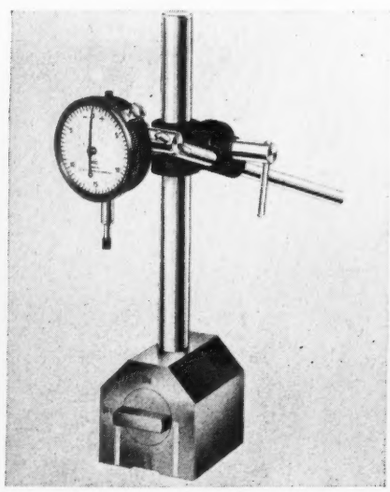
"Mechani-Seal" bearing is made with 2 steel plate shields, as innermost members, separated to form a trap and attached to the outer bearing ring, and a third steel plate pressed on the bearing inner ring and acting as a slinger when the inner ring is rotating. The outer members are given a corrosion-and rust-proof treatment. Available in single-seal, double-seal, seal and shield combinations on radial or wide inner-ring bearings. The Fafnir Bearing Co., New Britain, Conn.

Welding Helmet

No. 406 light-proof seamless welding helmet having reinforced side ribs is made in one piece without rivets from vulcanized fiber. The 2 ribs on each side are molded in the fiber to add to its rigidity and prevent warping. Other features include lens holder made so that the entire lens-holding unit may be removed by loosening 2 screws; a cover glass or welding lens removable without tools; an adjustable headgear. Chicago Eye Shield Co., 2300 Warren Blvd., Chicago.

Dial Test Indicators

Dial test indicators are equipped with magnetic bases that are said to hold to the face of a machine column or a small surface in upside down and other positions. When magnetic control is turned on, the



● Attached to every motor built by Fairbanks-Morse is a monogram. It weighs less than a feather—its tensile strength is negligible—but its protective strength is ten thousand times that of the strongest steel. Six simple words on the F-M monogram assure you that this motor represents the finest product of modern technical skill.

This monogram means that each and every rotor of each and every motor is dynamically balanced. It means all connections are welded, not soldered. It means sealed-in lubrication. It means that each finished motor —not every tenth or fifteenth motor—must pass rigid tests and painstaking inspection. In short, these six terse words on the F-M monogram mean that your investment is backed by 109 years of Fairbanks-Morse precision engineering.

For complete information about F-M motors, write Fairbanks, Morse & Co., Dept. 30, 600 South Michigan Avenue, Chicago, Ill. Branches and service stations throughout the United States and Canada.

7628-EA40.150

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
ELECTRICAL MACHINERY
FAIRBANKS SCALES
RAILROAD EQUIPMENT
WATER SYSTEMS
WASHERS-IRONERS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS

F-M Motors

magnetic flux goes through the base, base insert, and surface contacted by the base, thus holding the indicator in position. When off, the magnetic flux completes its circuits through the base and base insert without passing through the surface the base contacts, thus freeing the base. Equipment consists of a dial $2\frac{7}{32}$ in. in diameter; base $2\frac{3}{4}$ by $2\frac{7}{16}$ by $2\frac{7}{16}$ in.; upright $7\frac{13}{16}$ in. long; dial-holding rod 9 in. long. Brown & Sharpe Mfg. Co., Providence, R. I.

Flexible Coupling

Fractional-horsepower, bonded-rubber, flexible couplings, designed to accommodate parallel and angular misalignment, are said to be able to absorb torsional vibration and to prevent transfer of gear noise and motor hum through the shaft. Sizes range from $\frac{1}{16}$ up to 1 horsepower. Made as complete units without loose parts or projections. Lord Mfg. Co., Erie, Pa.

Belt-Type Work Loader

Portable, belt-type work loader, adjustable for height (3-ft. variation) and angle of incline (through an angle of 82 deg.), consists of a cleated endless belt conveyor assembly approximately 9 ft. long mounted on a caster-equipped stand. The loading chute is adjustable to the desired angle at the receiving end; delivery chute is adjustable at discharge end. Belt is 12 in. wide; usual speed is 60 ft. per min., it is claimed. A $\frac{1}{4}$-hp., single-phase, 60-cycle motor mounted on the conveyor frame furnishes the power. Wire mesh, for handling hot forgings, can be supplied in place of composition belting. Mechanical Handling Systems, Inc., 4600 Nancy Ave., Detroit.

Gravity-Feed Oiler

Visible gravity-feed oiler, with unbreakable reservoir cemented and roll-clinched to the brass base, is cadmium-plated to facilitate cleaning. Predetermined number of drops of oil per minute to be fed out is controlled by a ratchet-lever mechanism. The oiler is equipped with dual ratchet springs and a tension ring that fits over the springs to assure uniform pressure on ratchet feed and protect against vibration and careless handling. The dome hides the ratchet-lever mechanism; filler cap is dust-proof and self-closing; brass tube houses a needle-valve; sight fitting has wrench-grip at top. Available in 1-, 2-, 4-, and 8-oz. capacities. Trico Fuse Mfg. Co., Milwaukee.

Gas Mask

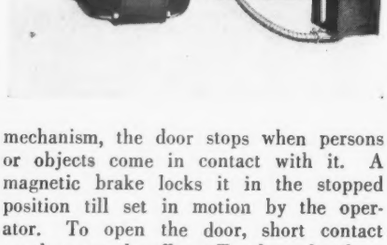
"All-vision" facepiece gas mask is made with stainless steel lens, frame, and trim; shatterproof Triplex lenses; "quick-action" fasteners; all-rubber headbands; and army-type exhalation valve. With inhalation tube and headbands, it weighs 18 ounces. It is claimed that the wearer's normal vision is not restricted; dead air space is reduced; deflector directs incoming air over entire area of lens; fit is gas tight; "pressure points" causing headaches are eliminated. Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh.

Spot-Welding Gun

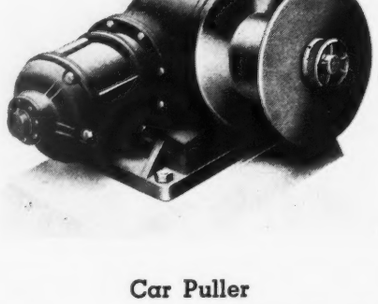
Hydraulically operated spot-welding gun, mounted on aluminum current-carrying extension handle, facilitates spot welding in relatively inaccessible locations—e.g. inside seams of a circulator heater cabinet. The 2 aluminum sections comprising the handle conduct current from the single-bolt cable connection at the input end to a similar connection at the gun end. Hollow section in handle carries water for cooling the gun and welding points. Hydraulic pressure supply to pressure cylinder on gun is carried in a flexible hose along the top of the handle. Wheel mounted on under side of extension handle helps maintain a steady weld and provide balance. Hydraulic booster mounted on the transformer supplies the pressure cylinder on the gun, timing control, etc. (Timing is automatic.) Progressive Welder Co., 737 Piquette Ave., Detroit.

Electric Door Operator

Model MC electric operators, for overhead doors, are furnished with motors of the 3-wire "instantaneously" reversing type which can be furnished for 110 or 220 volts, 60, 50, or 25 cycles, single phase, a.c., in $\frac{1}{6}$-, $\frac{1}{4}$-, $\frac{1}{3}$-, or $\frac{1}{2}$-hp. (varies with door size). Through a protective



mechanism, the door stops when persons or objects come in contact with it. A magnetic brake locks it in the stopped position till set in motion by the operator. To open the door, short contact on the control suffices. To close the door, contact must be continuous until door is fully shut. Gear train limit switch shuts off motor when door reaches fully open or closed position; prevents starting motor in opening direction when door is open, or in closing direction when it is closed. In case of power failure, a release disengages the sprocket from its shaft and permits manual operation. Barber-Colman Co., Rockford, Ill.



Car Puller

Wire-rope car puller, with horizontal capstan, has capacity rated up to 6 fully loaded cars, and is designed with heavy-duty clutch and flanged drum to operate with wire rope. The drum accommodates 500 ft. of $\frac{5}{8}$-in. wire rope. Heavy-duty clutch operated by hand wheel disengages drum to pay out rope. Stephens-Adamson Mfg. Co., Aurora, Ill.

Saw-Horse Brackets

"Clamptite" brackets, made of 3/32-in. pressed steel, may be used with legs measuring 2x4 in. or $1\frac{1}{4}$x3 in. Top piece of saw horse and leg length may be any length desired. Morse Mfg. Co., Inc., 400-408 South Franklin St., Syracuse, N. Y.

Lighting Units

Concentrator lighting units, lighting horizontal and vertical surfaces from an oblique angle, are for assembly work, inspection, spray booths, machine work, paint shops. Each unit consists of aluminum reflector, porcelain socket assembly, cast-aluminum socket housing, and aluminum swivel-mounting bracket for $\frac{1}{2}$-in. conduit mounting. One-piece reflector has diffuse or specular reflecting surface. Lenses of plain or stippled heat-resisting glass are fastened to the reflector by a split lens holding ring with self-spreading lug. Rubber gasket between reflector and lens provides a vapor-proof and dust-tight seal. Available in 2 sizes using 200-watt clear or inside-frosted bulb or 300- or 500-watt clear bulb. Westinghouse Electric & Mfg. Co., Cleveland.

Centrifugal Clutch

D-E automatic centrifugal clutch, for industrial power drives is applicable to power drives where starting loads are heavy, and to internal combustion engines with low torque at slow speeds. The clutch consists of 2 main parts—the housing drum or driven member, and the expansion body or driving member. A steel cover-plate seals

"Behold my genial grin!

I have had it ever since I saw the amazing power of Thor's new low-priced electric drill!"

1 **"I WAS PRETTY SCEPTICAL** when this jobber's salesman told me he had a new ½" electric drill for $35.00 that had plenty of power even for light production drilling."

2 **"'SHOW ME', I SAID.** *And he did!* He put a new Thor ½" Drill Champion on a sheet-metal bolt-hole job and it went through that stuff like a hot knife through butter . . . a clean hole and no stalling!"

3 **"'AT 35 BUCKS IT'S A BUY!',** says I . . . and ordered one for the shop. I like it because it does the work fast; the boys like it because it's so easy to handle . . . and the P. A. likes it because it costs so little!"

4 **"BUT THAT'S NOT THE HALF OF IT!** Since we got this Thor Drill Champion we're fighting to *keep* it in the shop. Either the maintenance man is using it all over the plant or the installation crew has sneaked it out on us. Looks like I'll have to get a couple more to keep peace in the family."

•

IT'S TRUE that everybody who sees the Thor Drill Champion likes it. That's understandable, because this new tool has exactly what you want in a light-duty tool — Economy and Performance at one low cost. Try the Thor Drill Champion for *your* general maintenance, installation or light production work and you'll see why there isn't a low-priced tool in the running with it today. Write for further information or a 10-Day Free Trial now.

INDEPENDENT PNEUMATIC TOOL CO.
608 W. JACKSON BLVD. · CHICAGO, ILLINOIS

Birmingham : Boston : Buffalo
Chicago : Cleveland : Denver
Detroit : Los Angeles : Milwaukee
New York : Philadelphia : Pittsburgh : St. Louis : Salt Lake City
San Francisco
Toronto, Ont. : London, England

Thor offers more!
IN
PORTABLE ELECTRIC TOOLS

CAPACITY .....½"
FREE SPEED .....450 r.p.m.
WEIGHT .....9¼ lbs.
LENGTH OVERALL .....15"

Save With the Great New
Thor
Drill Champion
HALF-INCH ELECTRIC DRILL

the mechanism against dust. The expansion body consists of 6 metal segments interconnected by tension springs and operating on individual posts extending radially from the driving hub. As the speed of the driving shaft increases, the expansion body of the clutch expands outward and the increasing centrifugal force is applied gradually against the friction lining of the housing. It is claimed that the "free-wheeling" action cushions starting shocks thus cutting down demand loads. The clutches can be furnished with plain belt pulleys, V-belt sheaves, or in the form of flexible-shaft couplings to meet power transmission problems of any speed or power requirements, it is said. Standard sizes range from 1-in. up to and including 2⅞-inch-diameter shafts, 0-125 horsepower. Dawes Equipment, Inc., 2280 Penobscot Bldg., Detroit.

Propeller-Type Fan

Propeller-type fan with motor outside the air stream has been designed for spray booth work and for installations where inflammable fumes, heat, or abrasive or corrosive elements are present. It incorporates an over-lapping ring, to which the motor base is welded, to increase air delivery by preventing backflow of air at propeller tips. A shield incases the belt. Propeller-shaft bearings are inclosed. Platform to which the motor is bolted is hinged to the base. Belt tension can be adjusted, it is said, by raising or lowering the side opposite the hinge by turning a single bolt. Standard sizes range from 17-28 in. propeller diameter. Hartzell Propeller Fan Co., Piqua, Ohio.

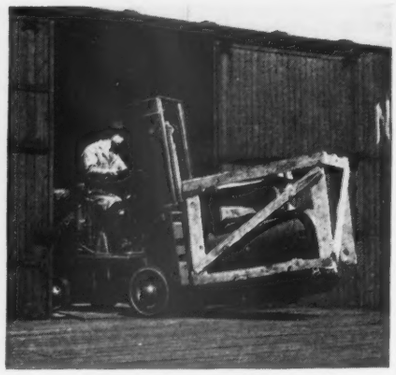
Crane Hoist Lowering Control

Lowering control, for a.c. crane hoists operated from a.c., features elimination of mechanical load-brake and Master-Switch control. It is said to provide unusual accuracy in inching operations. The Electric Controller & Mfg. Co., 2700 East 79th St., Cleveland.

Reflector Lamps

Line of 150 and 300-watt reflector lamps is for use in supplementary spot- and flood-lighting indoors. Type R-40 lamp, featuring a built-in reflecting surface, is used.

The lamps are equipped with medium screw bases to fit into conventional sockets, and should be used in porcelain sockets only. General Electric Co., Lamp Dept., Nela Park, Cleveland.



Carloader Lift Truck

Gas-powered hydraulic lift truck, with 47-in. wheel base, is for use in loading highway trucks and railway freight cars. Center-control type, it has a 2-wheel drive at the load-carrying end, and a 2-wheel steer at the rear permitting short pivot turns on either driving wheel. Speed is controllable from ½ to 8 m.p.h.—2 speeds forward and 2 reverse. Speeds of lift range from 40–60 ft. per minute. Box-type frame is all-welded steel plate; motor is mounted on rubber; oil pump for hydraulic lift is connected to the motor by constant drive to avoid clutching; lifting capacity is rated up to 4,000 lb. per load. Towmotor Co., 1233 East 152d St., Cleveland.

Storage Control

"Tellevel" dust-tight storage control, for starting and stopping conveyors feeding bulk materials to bins or hoppers, for opening and closing valves feeding liquids into tanks, operates automatically. However, by a change in wiring, it can be operated by control switch. Consists of a multiple-electrode, sealed mercury switch with fiber holder mounting screwed to top of tipping rod. Tipping it in any direction is said to break the electric current running the conveyor. Tipping rod is pivoted in a rubber diaphragm, the lower end fitting into a polished aluminum bell which provides dust-tight housing for switch and electric wiring. The housing is supported by a ½-in. conduit pipe. Stephens-Adamson Mfg. Co., Aurora, Ill.

Blueprint Machine

Occupying desk space 26x9 in., blueprint machine is said to make perfect blueprints in any size up to 18x24 in. in 1 minute or less. Original and sensitized paper is wrapped around a clear glass cylinder measuring 8 in. in diameter, 19 in. in length. Cylinder is held in place by a heavy canvas pre-shrunk adjustable cover. Timer controls 2 photo-flood bulbs inside cylinder to insure proper exposure time. Paramount Engineering Co., 5707 West Lake St., Chicago.

Radial Saw

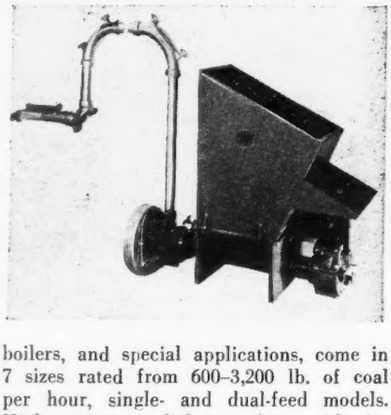
Radial saw that saws (cutting miters and compound miters both in ripping and crosscut positions) also cuts, grooves, rabbets, and tenons. With the proper tools it routs and shapes. As a woodworking machine it is for use in pattern and cabinet shops; crating and shipping departments; in metal shops for cutting sheet, rod, and bar stock when equipped with metal-working attachments. Features: Geared-head motor that provides a 2-in. depth cut with 1-hp. motor, 3-in. cut with 2-hp. motor, 4-in. cut with 3-hp. motor; voltmeter indicating sufficiency of line voltage being supplied to motor; magnetic circuit breaker switch protecting motor from overload operation; compensating gear to protect against stripping teeth. Sliding ram runs on dust-sealed ball bearings mounted on eccentric pins. Laminated maple table provides working surface. Walker-Turner Co., Plainfield, N. J.

Bronze Gate Valves

Non-rising-stem-type valve is furnished with a solid tapered wedge having full thread engagement with the stem when closed. The rising-stem type is equipped with a slip-on solid tapered wedge and can be supplied with a split wedge of ball and socket design. Both types are furnished with a follower gland. The stuffing box is packed with molded asbestos rings. The top seats permit the valves to be repacked under pressure when wide open, it is claimed. Wedges are of the reversible type and have heavy internal ribbing to prevent distortion when the valve is subjected to sudden shock. The body is reinforced with ribs at the side and bottom for resistance to pipe strain. Available in 10 sizes ranging from ¼ to 3 in. in pipe size. The Fairbanks Co., 393 Lafayette St., New York.

Pneumatic Spreader Stoker

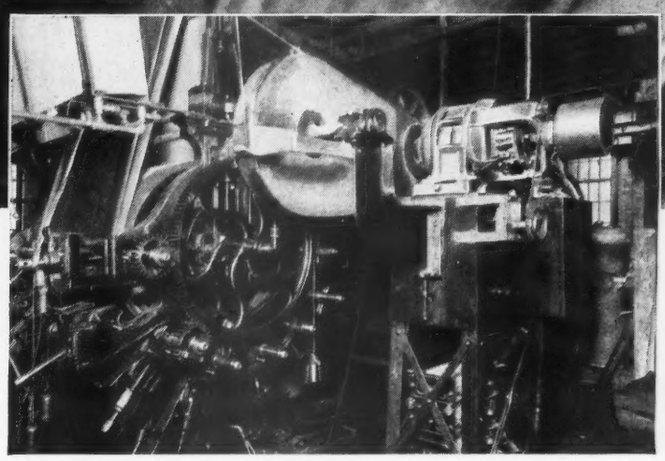
Pneumatic spreader stokers, for use in industrial power boilers, large heating



boilers, and special applications, come in 7 sizes rated from 600–3,200 lb. of coal per hour, single- and dual-feed models. High-pressure radial-vane fans with individual motor drives handle the combustion gases. The hot gases are utilized in conveying damp coal and in heating coal particles to accelerate combustion. Undergrate fan units may be located at front, side, or rear of boiler. The stoker may be located anywhere in boiler room within a 20-ft. radius of boiler front. Hopper of Series 51 has 1,200-lb. capacity; Series 52, 1,500-lb. capacity. Motors: 220- or 440-volt, 3-phase, 60-cycle, squirrel-cage type. Stokers may be equipped with a variable-speed

An Adjustable-speed A-c Motor that Meets Your Demands

Driving the wet end of a paper machine, this BTA motor has repaid its cost many times in improving the tensile strength and grade of paper



Installed 14 years ago, this BTA motor is giving dependable and efficient service driving a textile printing machine. This motor is equipped with a handwheel control for accurate speed adjustment

PROVED BY 16 YEARS' USE IN INDUSTRY

WHERE you want a variety of speed changes without installing d-c drives, gear-train arrangements, or belt-changing devices, the answer may well be one of General Electric's Type BTA motors.

The BTA motor can be conveniently adjusted for an unlimited number of speeds within its wide range. It gives instantaneous response to demands for higher or lower speed, and it may be controlled either directly by hand, or remotely by hand, push button, or automatic means.

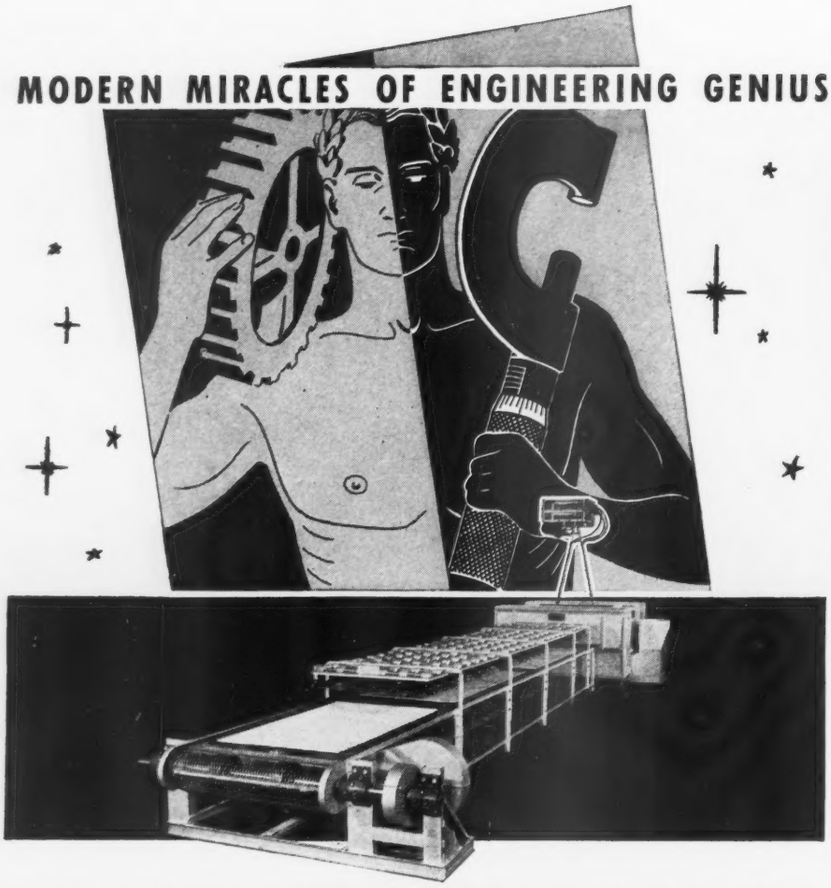
For industrial applications necessitating accurate speed control and high efficiency over a wide speed range, BTA motors have met the tests of time and use. Years of experience in their construction have made possible improvement of design, selection of the best materials, expertness in the methods of assembly, and rigid testing of the motors under actual conditions of service.

The BTA is excellent for use on printing presses, textile machines, paper winders, hoists, centrifugal pumps, fans, tube machines, conveyors, and many other applications where adjustable speeds are required. For further information, inquire of the nearest G-E office or write to General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

020-398

MODERN MIRACLES OF ENGINEERING GENIUS



KEEPING STEP WITH INDUSTRIAL PROGRESS, DEVILBISS ENGINEERS ARE SETTING NEW COST STANDARDS ON FINISHING AND COATING

WITH *Automatic*

SPRAYING EQUIPMENT

● With uncanny skill and unmatched speed, DeVilbiss Automatic Machines are miraculously performing finishing and coating operations which, in many cases, industrial executives believed couldn't be done automatically.

DeVilbiss engineers have designed automatic machines for hundreds of uses . . . finishing bottles, automobile wheels, pipe . . . coating strip steel, barrels and bread pans . . . treating hides, soap chips and breakfast foods. Each DeVilbiss machine handles the complete job from the application of the material to the ventilation of the finishing area—at bedrock cost.

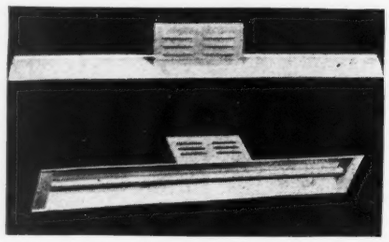
Don't pass up automatic spraying because you *think* your product, spray material or plant conditions are "different." It may be costing you big savings. If it's an automatic job, a DeVilbiss Spray Expert can tell you quickly. Call him today.

THE COMPLETE DEVILBISS LINE CONSISTS OF: Spray-finishing equipment . . . Automatic coating machines . . . Tanks for spray materials . . . Spray booths and exhaust fans for vapor and dust elimination . . . Air regulators, cleaners and dusters . . . Air Compressors . . . Respirators . . . Specialized hose for paint, air, water, gasoline, welding and pneumatic tools . . . Hose connections . . . Water and oil guns . . . Equipment to prevent offset in printing . . . Paint stripers . . . Medicinal atomizers . . . Perfume atomizers.

DE VILBISS SPRAY SYSTEMS

THE DE VILBISS COMPANY • TOLEDO, OHIO • U.S.A.

drive and adjustable motor base for either manual or automatic adjustment. The Iron Fireman Mfg. Co., Portland, Ore.



Lighting Units

Features claimed for Model HC-10 and HC-12 lamps are large light output; quality light approaching daylight; elimination of objectionable glare and shadow; power factor of 90 per cent; 40 lumens per watt; lamp life of 5,000 hours. HC-10 is available with 1 tubular lamp; HC-12 with 2 tubular lamps. Reflectors measure 58x8x8 inches. Current consumption: 110-200 watts. Flex-O-Lite Co., St. Charles, Ill.

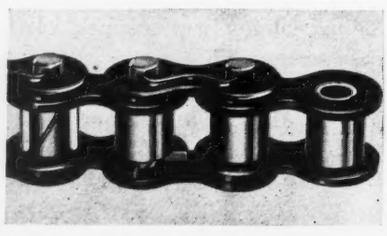
Transmission Belt

All-Neoprene friction-surface transmission belt, for use where oil and cutting fluids damage belts, is made without natural rubber, the friction and skim compounds being of synthetic oilproof material, thus reducing the amount of stretch in use. The friction and skim coat between all plies provides high flexing life over high-speed pulleys and protects the cotton duck against wear, ply separation, and softening from oil at high temperatures, it is claimed. Hewitt Rubber Corp., Buffalo.

Flexible-Shaft Machine

Applications of multi-speed flexible-shaft machine (addition to the Stow Junior line) include grinding, drilling, polishing, wire scratch-brush work. Consists of motor with extension cord and plug for any light socket, 4-caster base, adjustable arm for regulating belt tension, 3-step pulley, V-belt. The flexible shaft has an over-size flexible core with oil-resistant rubber outside casing. Motor end of shaft is reinforced and is fitted with Oilite bearing. Hand piece is fitted with ball bearings with labyrinth oil seal and removable clamp spindle. Available in ¼- or 1/3-hp. motor; speed range 875- 3,500 r.p.m.; drill capacity up to ⅜ inches. Stow Mfg. Co., Inc., Binghamton, N. Y.

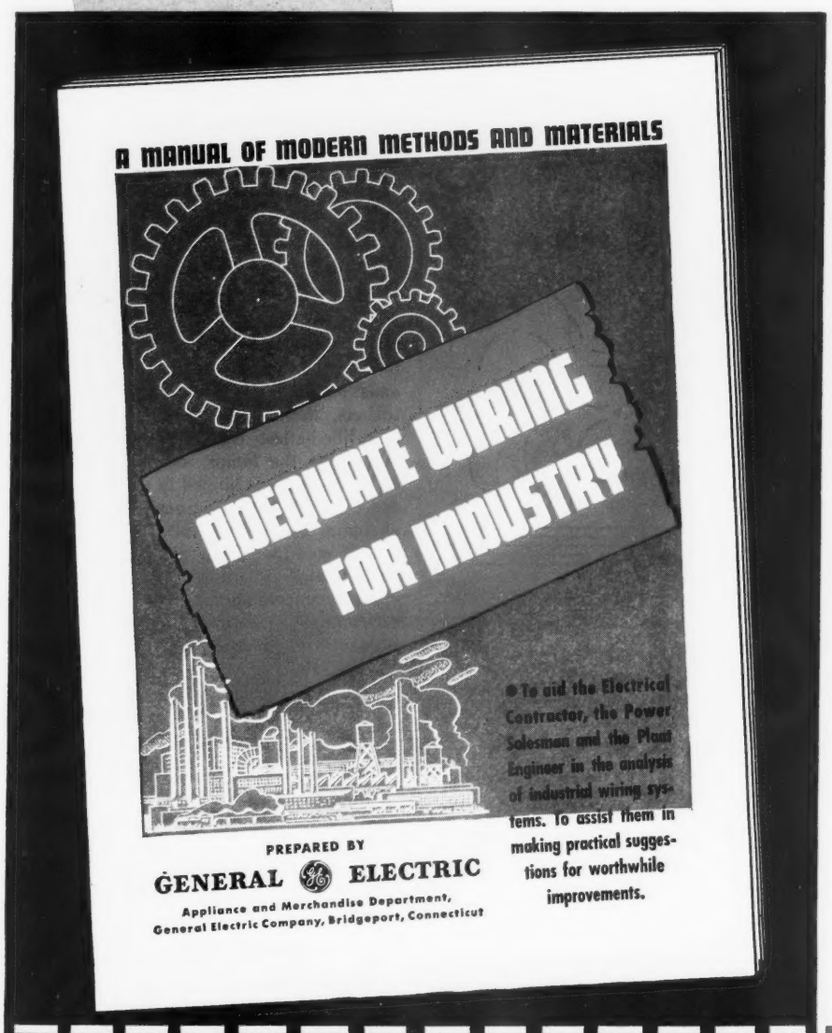
Roller Chain



FREE

General Electric Offers a New Manual on Modern Wiring Methods and Materials *Entitled*

"ADEQUATE WIRING FOR INDUSTRY"


A MANUAL OF MODERN METHODS AND MATERIALS
ADEQUATE WIRING FOR INDUSTRY
To aid the Electrical Contractor, the Power Salesman and the Plant Engineer in the analysis of industrial wiring systems. To assist them in making practical suggestions for worthwhile improvements.
PREPARED BY
GENERAL ELECTRIC
Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut

You can use this manual to check the wiring practices followed in your own plant. Possibly slight changes here and there in your wiring may result in savings you didn't think possible and in faster, better production.

After all, plant efficiency today depends on electrical wiring. No matter how much modern equipment you have, it can't operate satisfactorily if it isn't properly wired.

This manual doesn't attempt to lay down definite wiring rules because every factory has different requirements. But it does outline modern factory wiring practices which can be adopted in all factories to increase efficiency. It interprets wiring in terms of savings and service.

Case histories of several factories are given, demonstrating the benefits that result when wiring is modernized.

If the efficiency in your plant isn't as high as you think it should be, send the coupon below for this manual on modern factory wiring methods. By checking your wiring with the modern practices described in it, you may be able to make changes that will be of untold benefit to you.

General Electric Company
Appliance and Merchandise Department
Bridgeport, Connecticut
Section CDW-91012

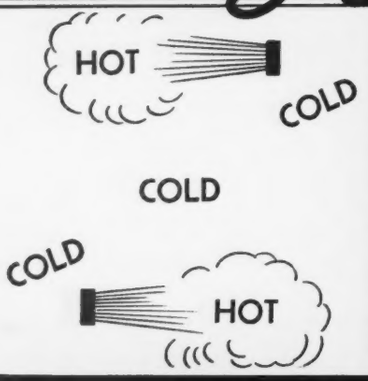
Sirs: Please send me free a copy of your new manual, entitled "Adequate Wiring for Industry."

NAME_____ ADDRESS_____

CITY_____ STATE_____

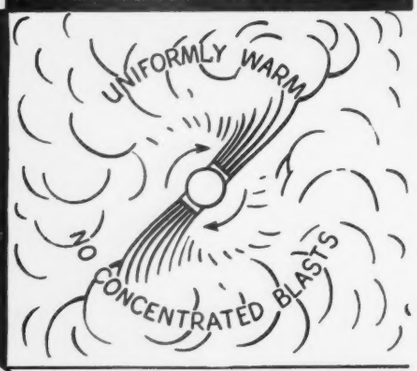
GENERAL ELECTRIC

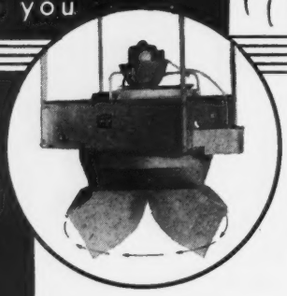
Heating Buildings



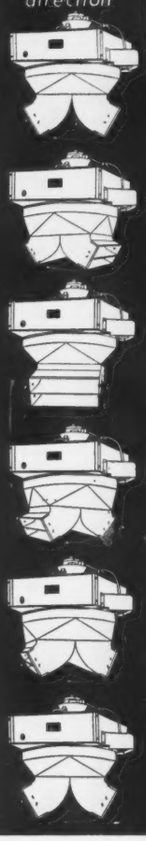
If the presence of hot spots and cold spots in your buildings is immaterial to you — you'll not be interested in this information

But if you wish to avoid them and improve the efficiency of your workmen and equipment and to preserve perishable goods here's information of vital interest to you





Diffuses heat in every direction



A new sensation of fresh, live, invigorating heat is created by this heater with the discharge outlet that slowly revolves.

No hot spots, no cold spots, no drafts can exist because the moving air stream produces an active state of air turbulence which results in a constant gentle air motion throughout the working area.

Even in plants where equipment or other objects would obstruct the flow of heat from a fixed discharge, the constantly changing direction of flow accomplishes complete coverage to the walls and corners of the plant.

Send for Bulletin H-7

L. J. Wing Mfg. Co.

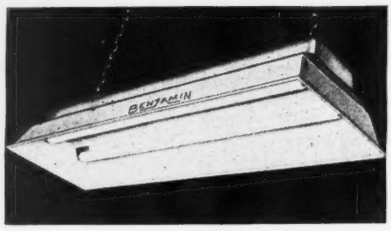
162 W. 14th Street New York, N. Y.

Wing *Revolving Discharge* *Featherweight* **UNIT HEATERS** *Floodlights of Heat*

Channel-lubricated roller chain, said to be interchangeable with standard roller chains, is of round-pin design with diagonal channels rolled into the stock from which the bushing is formed. When the joint is assembled, the channels appear as spiral grooves and extend through the side plates of the bushing link. The channels are designed to carry the oil through the side plates to the pins. Single, double, triple, and quadruple widths, and standard pitches and stock attachments, are available. Morse Chain Co., Ithaca, N. Y.

Twin-Lamp Fixture

Porcelain-enamel, single-reflector, twin-lamp unit, for the illumination of industrial



interiors, uses 48-in., 40-watt lamps. Both ends of the reflector are closed. Lamps, sockets, thermal glow-switch-type starters, and line-ballast equipment for regulating current to the lamps, are attached to the reflector which is hinged to the upper housing of the fixture. Suspension may be by chains or by rigid conduit. "Tulamp" type ballast units, which incorporate a capacitor in one lamp circuit, are used. One socket of each lamp is equipped with replaceable-cartridge-type thermal glow-switch starter. Benjamin Electric Mfg Co., Des Plaines, Ill.

Trucks

Type F-15 center-control fork truck has a rated capacity of 4,000 lb. and may be powered by a battery or gas-electric unit. Built as a telescoping or non-telescoping truck for tiering of pallet loads, it may be fiitted with a 2-prong fork or with a single or double ram for insertion under loads. Length and spacings of forks and rams depends on loads to be accommodated.

GEP-6 lift-platform truck, for handling material on skids, has speeds up to 10 m.p.h. and a rated capacity of 6,000 pounds. The 4-cylinder motor develops 33 boiler horsepower at a normal speed of 1,250 r.p.m., it is claimed. Elwell-Parker Electric Co., Cleveland.

Static-Pressure Regulator

Type P212A electric static-pressure regulator is for use in conjunction with a "Series 60 Floating" device such as a motorized damper, in controlling static pressure in discharge duct of a fan system, in controlling overfire draft in a combustion chamber, and in similar applications where definite static pressure conditions are to be maintained. Rating: 1

(*Continued on page* 102)

ONE OIL SOLVES ALL THREE OF THESE LUBRICATING PROBLEMS

● IN SPITE of the widely varying lubrication requirements on this turbine, reduction gear, and generator, Stanoil has held down the job of lubricating all of these units for three years and has established a record for economy.

The turbine and reduction gear were installed to drive a 25 cycle generator in a Wisconsin paper mill.* Lubricating the equipment presented the usual difficulty of lubricating three different units with one lubricating system. The reduction gear manufacturer desired an oil of different viscosity and type than that wanted by the turbine builder, but after discussion, a certain viscosity was agreed upon.

A Standard Lubrication Engineer was consulted. He explained how Stanoil would meet all the requirements on each of the units—it would resist high temperatures in the *turbine*, resist sludging or foaming under agitation in the *reduction gear*, and protect bearings under high pressure in the *generator*. All concerned agreed to give Stanoil a test. A recent inspection showed excellent lubrication of all parts on all three units.

Stanoil has many applications! Why not let a Standard Lubrication Engineer point out a few jobs in your plant where he thinks Stanoil can save money for you? Try it out. This service is available to all plant operators in the 13 Midwestern States served by these Engineers. It costs nothing. Phone the nearest Standard Oil (Indiana) office, or mail the card below for the Engineer in your locality.

**Name will be supplied on request.*

Copr. 1939, Standard Oil Co. (Ind.)

STANOIL

FIRST IN SERVICE
50 FOR FIFTY YEARS
STANDARD OIL (Ind.)

BRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LU

RICATION ENGINEERING...LU

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

FIRST CLASS PERMIT No. 252 (SEC. 510 P. L. & R.) CHICAGO, ILLINOIS

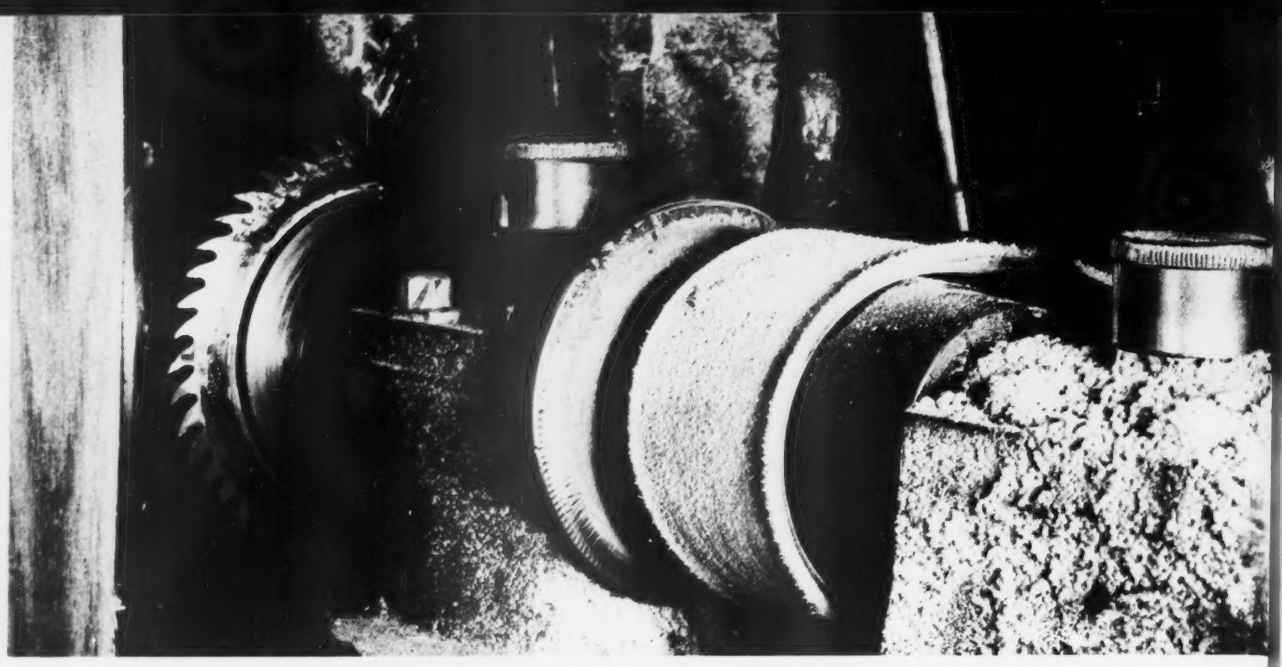
STANDARD OIL COMPANY (Ind.)

910 S. MICHIGAN AVENUE

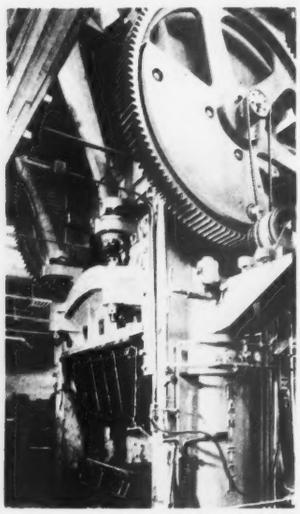
Mr. W. I. Nunn
Room 1217

CHICAGO, ILL.

ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION



Above: Spindle bearings on a cheese box machine in a Wisconsin plant, in which Superla Grease eliminated high consumption, leakage, and bearing



SUPERLA GREASE

Changing to Superla 2X grease for plain and anti-friction bearings saved about 50% in lubricating costs at the Metal Auto Parts plant in Indianapolis.

Superla 2X is used on the cups in the large forming presses. Superla No. 39 has proved "very satisfactory" in the centralized lubricating systems on these same presses after several years of operation.

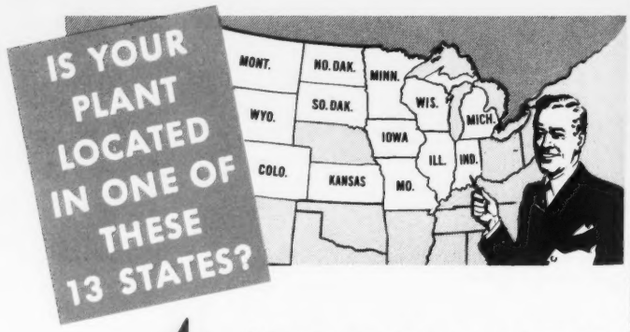
It's a simple matter to find out whether you are getting rock-bottom cost in grease lubrication. Let a Standard Lubrication Engineer test Superla on just one bearing in your plant. It won't cost you a cent—you may save plenty.

KEEPS DIRT OUT KEEPS BEARINGS IN

On its first trial Superla Grease was given the job of lubricating the bearings on the box machine spindles shown above.

Before Superla was used, these bearings failed frequently. Excessive leakage and high consumption were also serious problems. With Superla, less grease is needed for adequate lubrication. It stays in the bearings and dirt stays out. And bearing failures stopped.

There's a Standard Lubrication Engineer at your service at any time to help you with bearing or other lubricating problems. Call your local Standard Oil (Indiana) office or write 910 South Michigan Avenue, Chicago, Illinois.



GET THIS NEW LITERATURE

Two new interesting booklets on lubrication are available to all plant men in the 13 States shown on the map above.

"Spare the Time to Spare Your Machines," describes the latest development in a highly stable, long-lasting oil for many uses.

"How StanoCyl Cuts Oil Consumption," should be of interest to all power plant men concerned in the purchase or use of steam cylinder oil.

"The Lubrication Engineer—His Value to You," tells how these Engineers work and what they can do to help you reduce lubricating costs throughout your plant.

Check the subjects that interest you and mail the card. No postage is necessary.

STANDARD OIL COMPANY (Indiana) DECEMBER

910 S. Michigan Avenue, Chicago, Illinois.

Gentlemen: I am in one of your 13 Middle Western States.

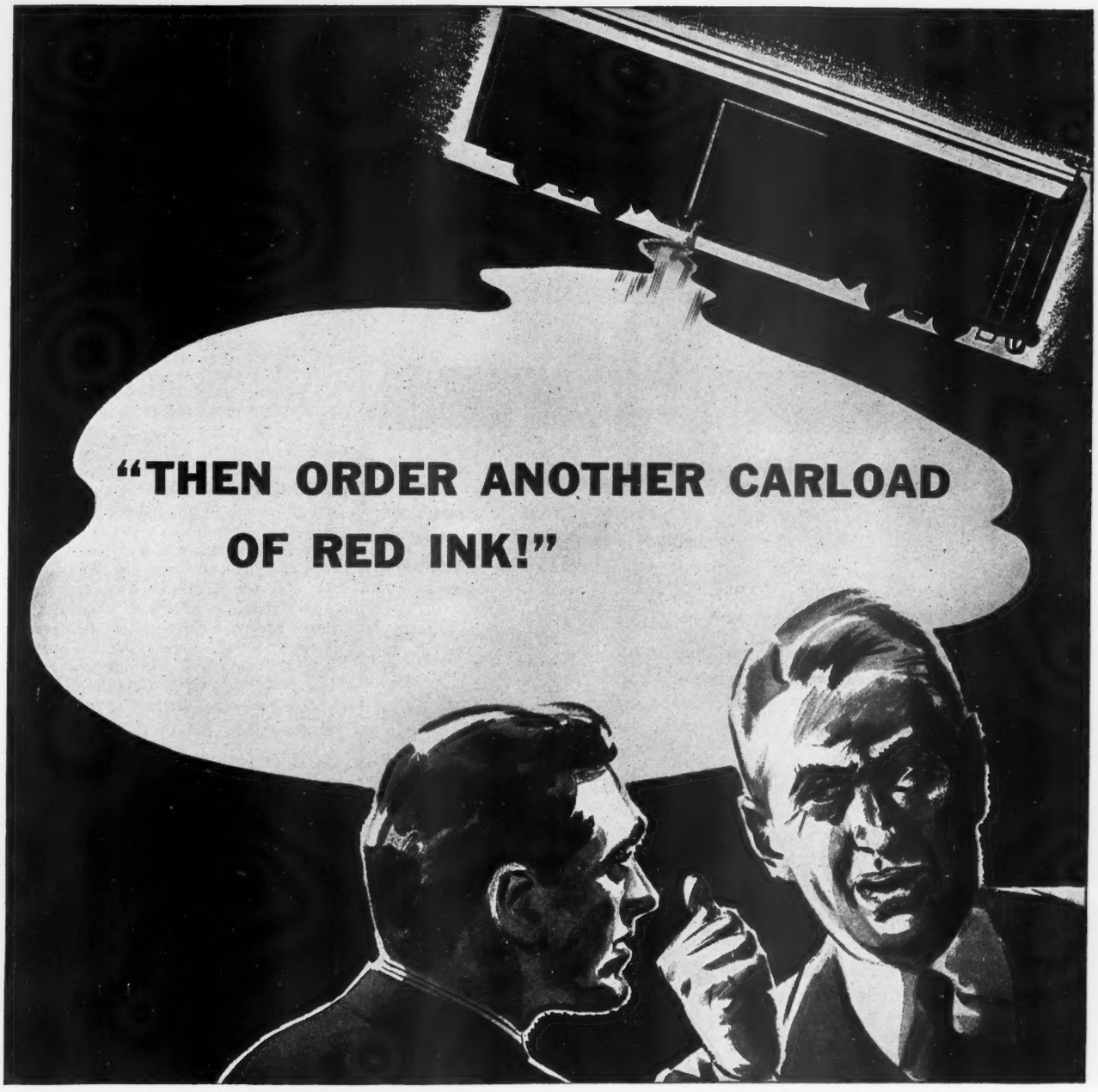
- ☐ Have your Engineer call.
- ☐ Do not have your Engineer call, but please send me the booklet (s) checked:
- ☐ "Spare the Time to Spare Your Machines."
- ☐ "How StanoCyl Cuts Oil Consumption."
- ☐ "The Lubrication Engineer—His Value to You."

Name ..... *Position* .....

Company .....

Address .....

City ..... *State* .....



"YOU don't seem to realize," said the president steadily, "that with material and labor costs—and taxes—so greatly increased, we can't spend . . ."

"Unless we do spend," the production executive interrupted, "to modernize and cut operating cost, you'd better order another carload of red ink."

"Just what do you suggest?"

"I suggest that we get a man in here to make a free survey of our plant and show us exactly where and how we can cut our operating costs and reduce waste."

The free survey was made. As a result of it, Taylor Automatic Controls were installed throughout the plant. Shortly the company was in the black . . . operating costs had been reduced by more than one-third.

* * *

THIS STORY is typical of the way Taylor is helping industry to overcome the problems of today—the problems of higher taxes, of increased material and labor costs. For Taylor shows you how to attack the one cost which you can reduce—operating cost.

Taylor Automatic Controls can insure the uniformity of your product... can reduce spoilage and speed production. This means more sales and greater profits for you.

Write today for a Taylor man to make a free survey of your plant. No obligation, of course. Taylor Instrument Companies, Rochester, N. Y. Plant also in Toronto, Canada. Manufacturers in Great Britain: Short & Mason, Ltd., London, England.

Taylor

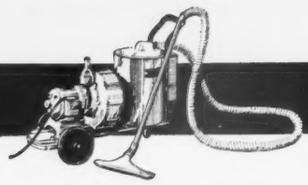
Indicating | Recording • Controlling

TEMPERATURE, PRESSURE, FLOW *and* **LEVEL INSTRUMENTS**

DO YOU WANT-

1 A MUCH CLEANER PLANT..?
2 LOWER CLEANING COSTS..?
3 FREEDOM FROM DUST-DAMAGE?

Then look what INVINCIBLE INDUSTRIAL VACUUM CLEANERS *will do*



First of all, they ***really clean*** because dust and dirt is ***removed,*** not scattered around to resettle and damage equipment, machinery and product. The plant is virtually dust-free.

Invincibles clean all types of floors, from rough concrete to highly finished wood, and will handle practically any kind of dirt and litter except in the presence of water or oil.

Crowded, close quarters are no handicap to Invincible Vacuum Cleaners. Far from it. Invincibles clean wherever brooms can be used and a lot of places where brooms cannot reach.

Overhead cleaning of pipes, beams, walls, etc., become easy operations with Invincibles. Incidentally, with Invincibles on the job, these parts of the plant ***stay clean*** much longer.

Invincibles are invaluable for cleaning bins, shelving, motors, machinery, boiler tops, workbenches, conveyor belts, etc. If desired they may be used as efficient blowers.

Invincibles substantially decrease cleaning costs. One Invincible Operator often does the work of ***three men*** with brushes and brooms and saves an average of $2000 per year in payroll.

Last but not least, Invincibles seem virtually indestructible. Thousands of them have passed their twentieth year of continuous service. Before you say, "Vacuum cleaning is not practical for our plant," *talk to Invincible.*

INVINCIBLE VACUUM CLEANER MFG. CO. ... 440 DAVIS · DOVER, OHIO

(Continued from page 98)

amp. at 25 volts, ¼ amp. at 110 volts, ⅛ amp. at 220 volts, a.c. Differential: Minimum—0.02 in. water column; maximum—0.60 in. water column. Range (when differential is included and when tank contains 1 gal. Finol): Positive pressure—0 to ¾ in. water column; negative pressure—0 to 1 in. water column. Adjustment: Movable weights for pressure range; adjustable contacts and spring for differential. Measurements: 8½x16x6¾ inches. Minneapolis-Honeywell Regulator Co., 2950 Fourth Ave South, Minneapolis.

Magnetic Switch

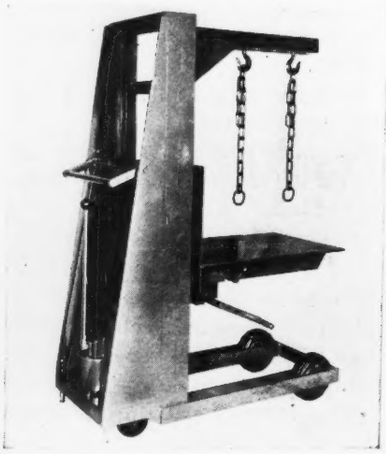
Size O magnetic switch is for use with single-phase motors up to 1 hp., 110 volts; 1½ hp., 220 volts; polyphase motors up to 1½ hp., 110 volts; 2 hp., 220-600 volts. It is made in 2-, 3-, and 4-pole forms. Available in general-purpose, dust-tight, and water-tight cases, with a push-button or selector switch for local operation. Features an E-type magnet with 3 sealing surfaces; a rivet-type built-in pole shader; removable double-break silver contacts. Isothermic overloads have a positioning spring to permit hand or automatic reset. Heaters, providing for different motor ratings, can be mounted in the relay from the front. A holding interlock is provided and 2 interlocks, normally open or closed, can be added. General Electric Co., Schenectady, N. Y.

Wire-Rope Sling

Loop-eye sling made of preformed Whyte Strand wire rope, features a tapered "Y-Guard" ferrule which is said to eliminate protruding ends or wire seizing, to afford hand protection, and to facilitate removal of sling from under loads. Macwhyte Co., 2906 14th Ave., Kenosha, Wis.

Die-Handling Truck

An adaptation of the cantilever type with hydraulic elevating table, this truck is furnished with a die separating and turning device and an adjustable clamp for holding various size dies. Winch, operated by a removable hand crank, is for pulling dies



See How Easy It Is to Get the Facts--
With G-E INSTRUMENTS

AND you don't necessarily need a switchboard full of them, either—sometimes a single Type AD-6 voltmeter, or one of the new G-E inkless recorders, will give you all the information you need to save on operating costs and to boost production. Sometimes two or three instruments will prove adequate and be a profitable investment.

For example, here's an instrument set-up on a box-type furnace: a Type AD-6 voltmeter and ammeter, both used in resistance measurements; a watthour meter to measure radiation losses. Yet with even such a simple arrangement, the operator knows at a glance *important* facts of operation. (A time meter counts the hours the furnace has operated, and a time switch turns the power on automatically.)

Perhaps one pocket-size portable will take care of your measuring needs—help you promote efficient operation, maintain product uniformity, prevent expensive shutdowns. But whether you need one instrument or dozens, you will find a G-E instrument for your particular job. For further information, call the nearest G-E office.

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

← **TYPE AD-6**
Rectangular Switchboard Instrument

Ammeters, voltmeters, wattmeters, power-factor meters and special instruments—with antiglare glass, antiparallax scale, magnetic damping, high torque, excellent accuracy. Available for surface or semi-flush mounting and also for d-c service. Write for Bulletin 1758-B. General Electric Company, Schenectady, New York.

GENERAL ELECTRIC

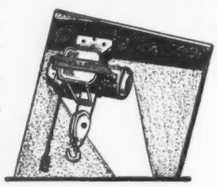
430-161

Introduced by Yale just a short time ago, the Cable King with its AIR-COOLING feature is already skyrocketing its way to leadership in the electric hoist field. NOW everybody wants AIR-COOLING!

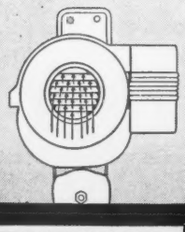
The reason is simple. AIR-COOLING saves the operator money. The basic limiting factor in electric hoist construction has always been excess brake heat. When Yale engineers adapted the special sirocco blower action that would cool the brake frictional parts they, *for the first time,* made it possible to eliminate this heat.

That's the principle of AIR-COOLING—a principle that permits *the Cable King to operate on a heavier duty cycle than any other hoist in the same class.* And that means *greater economy than any other hoist in the same class!*

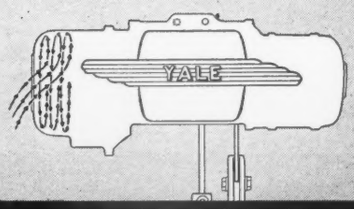
In addition, the precision construction of the Cable King makes it the closest approach to perfect engineering specifications that has ever been built. AIR-COOLING plus mechanical perfection—that's what you get in the Cable King. It's the very latest advance in hoisting equipment. Contact your local distributor or send direct for free catalogue.



STARTLING AND EXCLUSIVE AIR-COOLING PRINCIPLE...



The Greatest Economy Factor Ever Developed in Electric Hoist Construction.



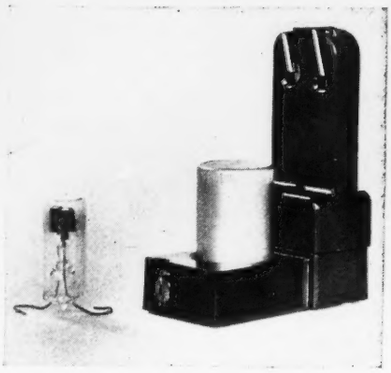
YALE

THE YALE & TOWNE MFG. CO.
PHILADELPHIA DIVISION, PHILADELPHIA, PA., U. S. A.
IN CANADA: ST. CATHARINES, ONT.

on and off the table. The caster wheels are hard rubber tired. Rear wheels are roller compound rubber tired. Truck is of castered-steer type. Two-speed hydraulic pump operates at slow speed for elevating heavy dies and high speed for lighter dies. Available in various specifications. Lyon Iron Works, Greene, N. Y.

Rotary Pumps

Type DC rotary pumps are said to have a maximum capacity of 20 gal. per min. when direct-connected to 1,800 r.p.m. standard motors. Built in 3 constructions—all iron, bronze fitted, and all bronze—they are for use in handling any clean liquid. The pump is self-priming and can handle pressures up to 100 lb., it is claimed. Can be furnished with standard or Chevron type packing; is fitted for grease-gun lubrication; has inlet and discharge connections (screwed type) measuring 1¼ inches. Blackmer Pump Co., Grand Rapids, Mich.



Fluorescent Lamp Auxiliaries

Fluorescent lamp starter and a current-limiting device known as the fluorescent lamp ballast. Replaceable starter is located in a special socket attached to a fluorescent lamp holder by a single screw. It is said that the power factor for the 2-lamp type is corrected to approximately 0.95, and that when the lamps are adjacent much of the stroboscopic effect is overcome. The glow switch is the heart of the starter. The glow tube and capacitor are housed in an aluminum shell with bayonet end and fit into the starter socket. Ballasts will be available for single- and 2-lamp operation. Westinghouse Electric & Mfg. Co., East Pittsburgh.

Ball Bearings

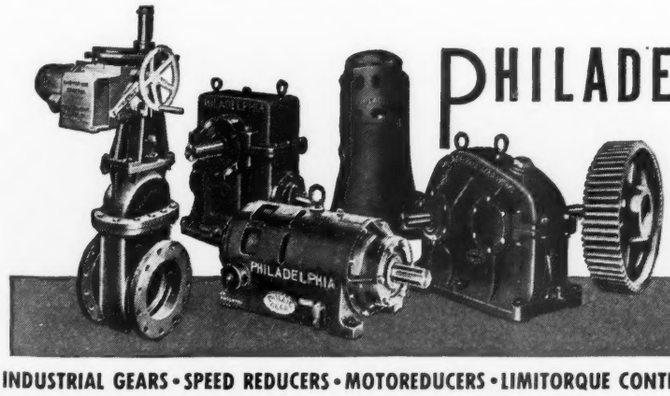
Two series of light-weight, felt-sealed ball bearings, for high-speed units demanding minimum weight and maximum room, are available in 5 types which, for a housing of given diameter, are said to permit using a shaft of larger diameter, and for a shaft of given diameter to permit using a housing of smaller diameter. Series 6000 is furnished with a single felt seal, or with felt seal and side plate or shield within the bearing. The seals are held in the grooves of the outer ring and are removable for examination, cleaning, or relubrication of the bearing. The 6000 series is

"IT'S EASY TO SEE DUST IS A PROBLEM IN THIS PLANT....

. . . SO THEY TOOK NO CHANCES—*THEY CHOSE A PHILADELPHIA HERRINGBONE SPEED REDUCER"*

There is no chance for dust, dirt, moisture, or fumes to get inside the sturdy gray cast iron housing of PHILADELPHIA HERRINGBONE UNITS . . . nor can the smooth operation of the high quality, heat treated gears be affected. Bearings and gears are splash lubricated, oil seals being used to prevent leakage. All shafts are mounted on anti-friction bearings of ample size which permit overhung loads.

PHILADELPHIA HERRINGBONE UNITS are built in Single, Double and Triple Reductions . . . so you know there is one to fill your needs. Write us for full details.



PHILADELPHIA *Speed Reducers*

PHILADELPHIA GEAR WORKS

Erie Avenue and G Street, Philadelphia, Pa.

NEW YORK • PITTSBURGH • CHICAGO

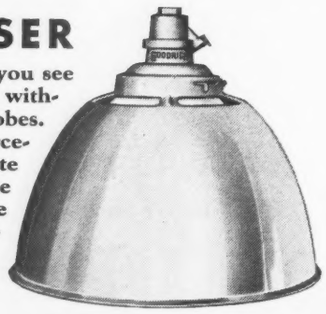
INDUSTRIAL GEARS • SPEED REDUCERS • MOTOREDUCERS • LIMITORQUE CONTROL

HOW THIS NEW *FIXTURE* PROTECTS EYES FROM GLARE

It's designed especially to illuminate areas where skilled eyes need protection from glare and injury. Unlike other combination reflector and globe fixtures, it has a deep-skirted reflector which hides its light source from the field of vision. This design permits the use of a diffusing globe of exceptionally high transmission value to obtain increased efficiency and more accurate light control.

"PROTECTO" DIFFUSER

As you look down a row of these fixtures, you see only the pleasing effect of the illumination without the glare that is common to protruding globes. With the high reflection factor of white porcelain enamel, shadows are softened and minute details are clearly revealed. A portion of the light is directed toward the ceiling to eliminate sharp contrasts and improve general illumination. The "Protecto" diffuser is an exclusive Goodrich product. Ask for catalog sheets.



Sold Only Through Electrical Wholesalers

MEMBER OF R. L. M. STANDARDS INSTITUTE

GOODRICH
ELECTRIC COMPANY
OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 2904 N. OAKLEY AVENUE, CHICAGO, ILL.

available up to 25 mm. bore. Series 6100, available up to 45 mm. bore, is supplied without side plate or shield, with one side plate, or with 2 side plates. Norma-Hoffmann Bearings Corp., Stamford, Conn.

Weld Timer-Contactor

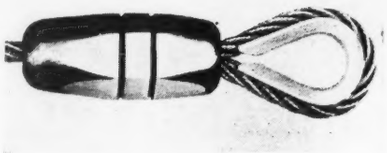
Model 90-53 combination weld timer and contactor, for timing control of manually operated spot welders (1-15 kva., permits welding of stainless steel, aluminum, brass, it is claimed. Consists of an electronic tube, a relay, a contactor, and a time selector switch, mounted in a spring-hinged cover case. Moving time elements have been eliminated. Contacts are replaceable. Available for 110, 220, 440 volts, and 25, 50, or 60 cycles, it is adjustable in 1-cycle steps over the 1- to 60-cycle timing range. Weltronic Corp., 2823 East Grand Blvd., Detroit.

Air-Filter Silencers

Filter-silencer units available in 2 types —Oil Bath and Unimaze, are for application where it is desirable to silence intake noises and provide protection against dust and grit. The Oil Bath unit comes in 31 models with capacities ranging from 50–4,000 cu. ft. per minute. The Unimaze unit comes in 12 models. The Air-Maze Corp., 5200 Harvard Ave., Cleveland.

Wire-Rope Clamp

"Safe-Line" clamp, designed to eliminate splicing and serving, is made of high tensile strength steel. Inner surface that grips



wire rope is double spiral splined to fit each strand and wire of the rope. Gripping halves are held to rope by taper-threaded nuts. Joints made can, it is said, be readjusted to proper tension. Available in 9 sizes for ropes ⅛ to ¾ in. in diameter. National Production Co., 4561–4603 St. Jean Ave., Detroit.

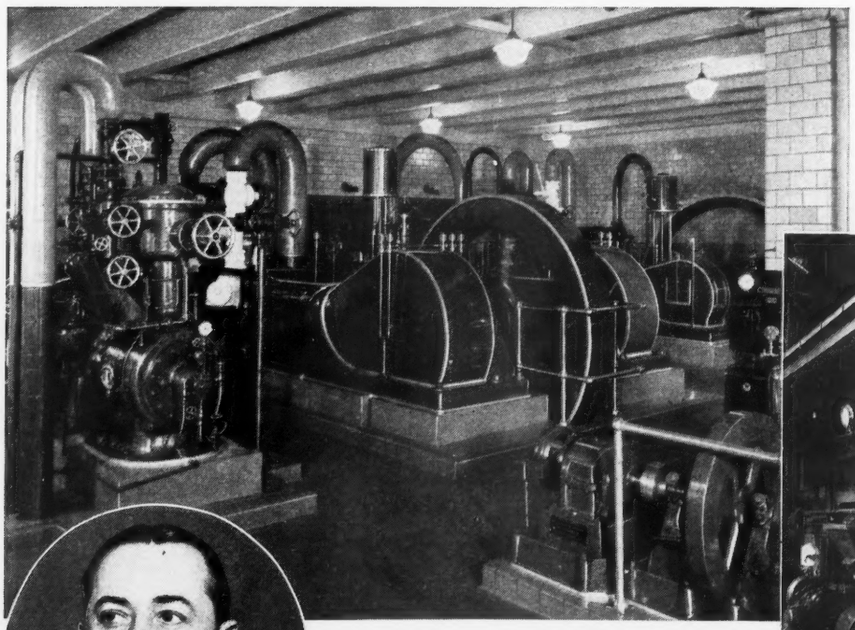
Cycle Timer

Cycle timer is for use on a.c. circuits in continuously closing and opening a single circuit at a pre-set operating interval; in alternately opening and closing 2 circuits—1 circuit opening instantaneously with the closing of the other and vice versa. Used to control timing of coal stokers, and day and night operation of thermostats, automatically; to start and control duration of operation of electrically operated machinery, periodically. Features: 8 time scales ranging from 1 revolution in 60 sec. to 1 revolution in 24 hr.; 4 operating arms to a dial—2 "on" and 2 "off"—so that 1 or 2 cycles

"Substantial Reductions

IN OUR OPERATING COSTS"...

says
Chief Engineer
Samson



STEAM-DRIVEN AMMONIA COMPRESSORS in the plant of the Goebel Brewing Co., Detroit. *Switching* to Texaco Lubricants 4 years ago, Chief Engineer Samson has effected a 75% reduction in maintenance cost.

•

Left: **R. J. SAMSON,** Chief Engineer of Goebel Brewing Co. plant, reports that Texaco saves him lubrication worries, and enables him to show substantial reductions in operating costs. He recommends Texaco Lubricants and service.

MODERN BOILER ROOM of the Goebel Brewing Co., Detroit, presided over by Chief Engineer R. J. Samson, shown opposite. Aided by Texaco Lubricants and Texaco Engineering Service, Mr. Samson has shown a power saving of 8%. Naturally, he is enthusiastic for Texaco, based on the results he is getting.

IN 1935, the Goebel Brewing Company power plant in Detroit began to use Texaco Lubricants. Because of his success with them, Chief Engineer R. J. Samson says:

"Texaco saves me lubrication worries, and enables me to show my Company substantial reductions in operating costs. I recommend both Texaco and its service."

The Goebel plant is Texaco lubricated 100%. It uses Texaco steam cylinder oils in the steam ends of its compressors, Texaco Capella in the compressors, and Texaco Regal for gravity circulating external lubrication.

Engineers, trained in the selection and application of Texaco power plant lubricants, will gladly demonstrate savings with Texaco Perfected Lubrication.

For prompt service and deliveries, phone the nearest of our 2279 warehouses in the U. S., or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

TEXACO
REG. T.M.

Texaco Dealers invite you to tune in The Texaco Star Theatre—a full hour of all-star entertainment—Every Wednesday Night — Columbia Network — 9:00 E.S.T., 8:00 C.S.T., 7:00 M.S.T., 6:00 P.S.T.

TEXACO Steam Cylinder Oils

THEY WOULDN'T MISS IT FOR ANYTHING

THEY'LL devote 5 days at the International Heating & Ventilating Exposition to great advantage. Their business and professional progress depends on adopting what's new and good in heating, ventilating, air conditioning.

Over thirty thousand visitors will learn what more than three hundred exhibitors have perfected for modern industrial and commercial installations. They'll see these products with their own eyes, watch demonstrations, make comparisons, ask questions, get useful answers, meet and make friends. Of course they wouldn't miss this great exposition.

Note the date and be there too. Learn how new equipment developments may be of help to you. Admission is by registration. You are cordially invited to attend. 105

THE AIR CONDITIONING EXPOSITION

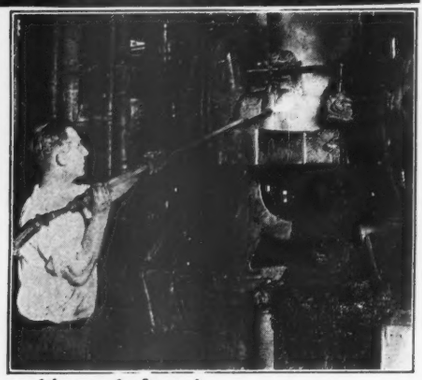
6th INTERNATIONAL HEATING & VENTILATING EXPOSITION

LAKESIDE HALL
CLEVELAND, OHIO

Auspices American Society of Heating & Ventilating Engineers
Management, International Exposition Co.

JANUARY
22-26, 1940

INSURE MAXIMUM MACHINE HOURS

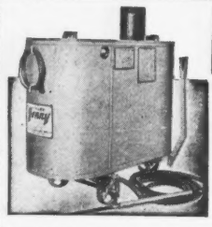


STOP COSTLY SHUT-DOWNS *with* HYPRESSURE JENNY

Hypressure Jenny Steam Cleaning of machinery before inspection, repair, or use, helps to prevent machine hour losses by uncovering sources of weakness—strain cracks, worn parts, etc. Also saves 25% to 40% of your mechanics' time now wasted in fighting dirt and grease. Additional remarkable savings in cleaning floors, windows, walls, lavatories, trucks, and manufactured products before painting. Find out how much YOU can save. Return the coupon for a free survey.

HOMESTEAD VALVE MFG. CO., P. O. Box 86, Coraopolis, Pa.

Mail THIS COUPON FOR FREE SURVEY



O. K.! Send that Survey.
Tell us how much JENNY can save us.

We employ.....mechanics on dirty greasy repair work.
We clean.....pieces of machinery monthly.
We clean.....sq. ft. of industrial windows annually.
We want to clean ☐ small tools, ☐ machines, ☐ cranes, ☐ runways, ☐ floors, ☐ walls.

Name .....
Address .....

of operation can be independently obtained in 1 revolution of the dial; adjustable operating arms; light-weight rotor and slow-speed gears with sealed-in lubrication; snap-acting switch mechanism rated to carry a ½-hp. motor load, 1,200-watt heater load, or a 1,000-watt lamp load; 2.8-watt, slow-speed synchronous motor; 4 knockouts for ½- or ¾-in. conduit connection. W. Cramer Co., Inc., Centerbrook, Conn.

Unit Heater

Main features of redesigned unit heater

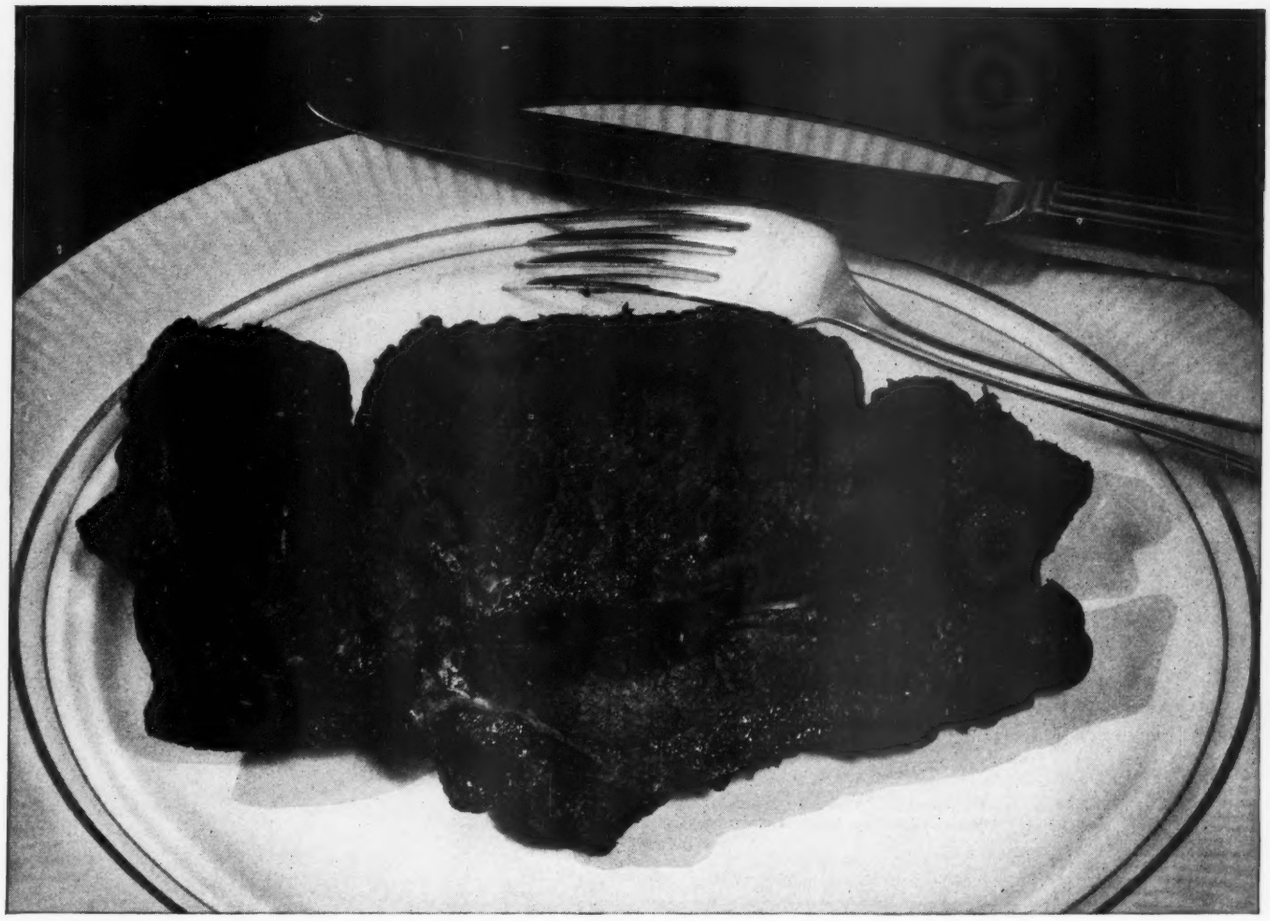
include sound silencing effected by acoustical mastic lining the case; stationary fan evening air flow through condenser; Venturi fan shroud reducing air inrush noises; concentric rings on safety fan guard dissipating vibration; and motor mounted in rubber on the fan guard. Bonderizing protects sheet metal parts against rusting where units are set in moist places or where corrosive fumes are prevalent. The Modine Mfg. Co., Racine, Wis.

Generator-Voltage Regulators

Diactor generator-voltage regulators, for use with a.c. and d.c. machines, will be available in 6 ratings for generators rated 15,000 kw., 3,600 r.p.m., and for smaller machines at lower speeds. The smallest is designed for generators up to 25 kilowatts. Features a totally inclosed case; rheostatic-type regulator containing a torque element which eliminates pivots and bearings; a self-aligning spring suspension. Advantages claimed: Increased illumination of lights; more satisfactory operation of heating appliances; assurance that motors operate in accordance with their design characteristics. General Electric Co., Schenectady, N. Y.

Recessed-Lamp Receptacles

Model G recessed-lamp receptacles, for use where indicating lamps are used to mark exits, fire boxes, fire hose, extinguishers, are made in 2 sizes to hold the G10 Neon lamp and the G11 7½-watt tungsten lamp. The units house the lamps so that only a small portion of the lamp is exposed and the lamp tip assumes the appearance of a lens, the light value remaining unimpaired, it is claimed. A heavy-duty socket with screw terminals in the rear is fastened to the brass shell. A locking nut permits



Who wants a CRISP Steak?

If you're like us you want it medium, but the pan-broiled wreck above shows that too much heat can transform a tender steak into a charred cinder in nothing flat.

It's something to think about if you are using wire insulated with organic materials in places where the temperature hits the high spots. Like the steak, the insulation begins to dry out and lose flexibility under continued exposure to heat, finally becoming so hard and brittle that vibration opens up cracks, leaving it just about as moisture-resistant as a piece of cheese-cloth. And when that happens it isn't long before you are hauling out and replacing . . . and you are going to keep it up if you use the same stuff again instead of a 100% heat resistant wire like Rockbestos, designed to give real service in such locations.

Rockbestos asbestos insulated wires and cables won't dry out or crack under heat exposure or with age. Corrosive fumes won't rot their insulation and neither will oil or grease cause it to bloom or swell. These and the rest of the Ten Tested Rockbestos Values will help you reduce maintenance expense and equipment outage as they have helped others. Send for samples and our Catalog No. 10-E. Write to us or our nearest branch office. Rockbestos Products Corporation, 941 Nicoll St., New Haven, Conn.

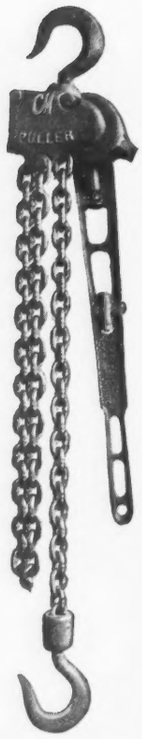
TEN TESTED ROCKBESTOS VALUES

1. Heatproof
2. Fireproof
3. Permanent
4. Lower maintenance cost
5. Resists heat and vibration
6. Saves work
7. Oil, Grease and Moisture resistant
8. High overload capacity
9. Permanently flexible
10. Greater carrying capacity

"Diamond Jubilee of Asbestos' Service to Humanity."

New York Buffalo Cleveland Detroit Chicago
Pittsburgh St. Louis Los Angeles San Francisco Portland, Ore. Seattle

When it takes PULL to get the job done

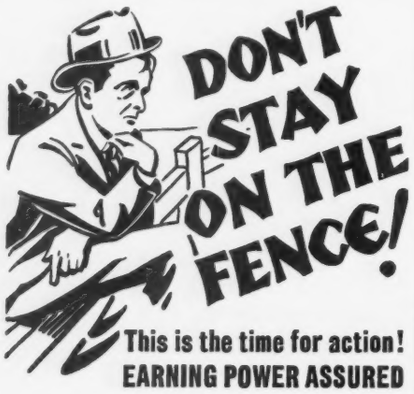


THIS "CM" PULLER PULLS AND LIFTS FROM ANY ANGLE!

It's a compact, mechanical power unit—This "CM" PULLER—and a tool with a hundred and one uses, such as stretching wires, cables and fencing...in trench work ...in mine service...construction...general maintenance.

It's easy to handle and operate. One man can pull or lift up to 12,000 lbs. The ¼ ton model weighs only 17 lbs., and 43 lbs. of effort pulls ¾ ton load..."Herc-Alloy" double duty chain cannot kink in service or storage. All working parts enclosed. Gear reduction on all sizes. Drop forged gears, shafts and lift wheel. Want details? Ask your dealer or write for Bulletin No. 134.

CHISHOLM-MOORE HOIST CORPORATION
(Affiliated with Columbus-McKinnon Chain Corp.)
130 FREMONT AVE. TONAWANDA, N. Y.
Branch Offices: NEW YORK • CHICAGO • CLEVELAND



DON'T STAY ON THE FENCE!

This is the time for action!
EARNING POWER ASSURED

A man's earning power—no matter his status—in your plant is important to you because through him you produce dollars. Don't impair his capacity for doing fast, economical and profitable work. Provide him with the *very best* safety equipment — because it's a means for you to earn more yourself. This new catalog shows the way.

Write for FREE CATALOG

CHICAGO EYE SHIELD COMPANY
2331 Warren Blvd. Chicago, Ill.

Please send by return mail your new catalog.
Name .....
Company .....
Address .....
City ..... State .....

JOHNSON'S 501 Soldering Furnace does many jobs at a new low cost

THE famous Johnson 501 has many cost-cutting features that help you increase efficiency and reduce expenses! Removable curved hood returns flame-blast over work for more intense heat and efficiency. Johnson's Direct Jet Bunsen Burner burns all types of gas hot and clean. Soldering coppers up to 6 lbs. per pair are handled easily. Firebrick base and durability are longer life. Efficiently heat-treats carbon steel tools and parts. Write now for free catalogue.

JOHNSON GAS APPLIANCE CO.
Cedar Rapids IOWA

single-hole panel mounting. The lamp is removable from the front. Two of the 4 models available are furnished mounted on a standard switch plate complete with screws to mount on a standard outlet box. H. R. Kirkland Co., Morristown, N. J.

Multi-Breaker

Type MO multi-breaker, for short-circuit and overload protection for branch lighting circuits for high-wattage appliances, for protection of small motors, is available in

12-, 20-, and 25-amp. capacities. Advantages claimed: breaker calibrated and sealed at factory; handle trips free; faulty circuits indicated; contacts of non-welding and non-corrosive material. The breaker is furnished for flush or surface mounting and is provided with insulated or grounded neutral, or no neutral. The Trumbull Electric Mfg. Co., Plainville, Conn.

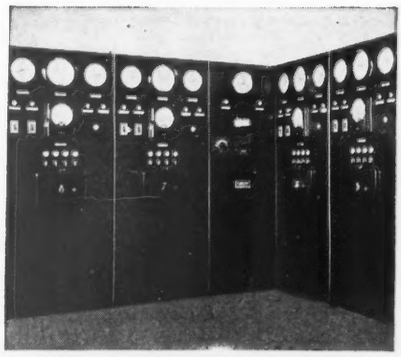
Oil Faucet

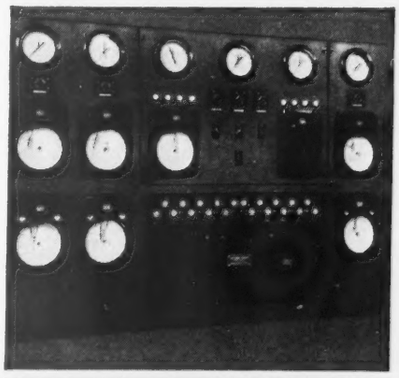
"Molygate" oil faucet, for use in dispensing lubricating oil, paints, varnishes, glue, vegetable oils, molasses, and other viscous fluids from sealed or unsealed barrels and drums, features a neoprene seat vulcanized into the valve head to prevent leakage, and a lug for sealing to sealed drums. For protection against dripping, a shut-off valve is located at the end of the nozzle. A stainless steel spring insures automatic closing. The opening lever can be padlocked in closed position. Rate of flow for the standard ¾-in. size is said to be 2 quarts of S.A.E. 50 oil at 78 deg. F. in 9 3/5 sec. under a 2-ft. head. Two sizes: ¾ in. for standard steel drums; 1 in. for oil companies' sealed drums. Bronze or nickel finish. The Imperial Brass Mfg. Co., 1200 West Harrison St., Chicago.

Time Starter

Time starter, for general-purpose constant-speed motors where jogging is not required, is rated up to 5 hp., 115 volts; 10 hp., 230 volts. Consists of a solenoid-operated multifinger contactor with an overload relay. It employs a time-delay escapement mechanism which is said to be in constant engagement with the operating shaft restraining the shaft in the starting motor but permitting quick opening through an

NOW, YOU CAN PROFIT from complete automatic control of your plant processing!





Another feature of BRISTOL'S SYSTEM of COORDINATED PROCESS CONTROL that helps you end rejects, cut costs, improve quality!

For plant processing to be carried on at maximum profit, yield must be consistently constant. Quality must be up to standard. Processing time must not vary. Costs must be held within permissible limits.

Should, for example, temperature, flow or any other process variable fluctuate—should one or more of these not be properly coordinated with the others—should there be any irregularities in the proper time sequence of the mechanical operations of valves, motors or pumps — *process costs soar,*—often to such dangerous heights that profits disappear. Product quality suffers, rejects multiply, and then there is plenty of worry and grief for management.

To avoid this, the modern trend in industry is to put a whole process, from beginning to end, under *complete automatic control* by means of Bristol's System of Coordinated Process Control. Then every variable, every factor—even critical operations—are closely controlled with the result that product is rigidly uniform.

For a more complete appreciation of how effectively Coordinated Process Control is banishing the uncertainties of obsolete practices and making possible new standards of performance and economy, write for Bulletin No. 460-511F. No obligation.

In Wide Use Today

This modern technique of process control is now being used by some of the most progressive and successful manufacturers in this country.

More Than Just Instruments

Bristol's System of Coordinated Process Control is made possible *only by the combination* of (a) the ability, experience and facilities of the Bristol's engineering staff to apply to a given plant problem a simplified layout of modern instruments providing complete coordinated process automaticity, (b) Bristol's Process Cycle Controller, the "mechanical brain" of coordinated process engineering, and (c) the complete line of Bristol's controlling, recording and indicating instruments for pressure, level, temperature, humidity, flow, motion, electrical quantities, etc., —a complete service backed by Bristol's undivided responsibility.

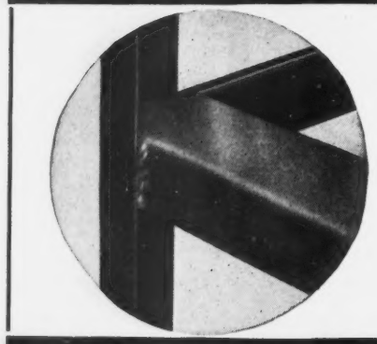
THE BRISTOL COMPANY
WATERBURY, CONNECTICUT

Branch Offices: Akron, Birmingham, Boston, Chicago, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Seattle. Canada: The Bristol Company of Canada, Limited, Toronto, Ontario. England: Bristol's Instrument Company, Limited, London, N.W. 10

Bristol's System of COORDINATED PROCESS CONTROL

INDUSTRY'S GUIDE TO A UNIFORM PRODUCT

WELDED JOINTS



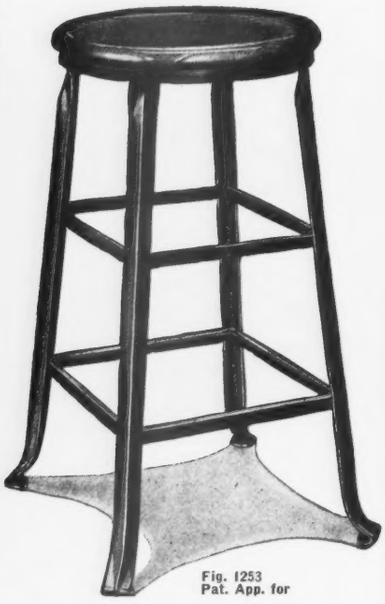


Fig. 1253
Pat. App. for

"HALLOWELL" STEEL STOOLS

Steel construction for lasting wear . . . welded joints for lifetime rigidity make "Hallowell" Stools the logical choice for your seating equipment.

Your logical selection from the standpoint of price, too. For not only is the initial cost surprisingly low, but "Hallowell" Steel Stools are a lasting investment—and they pay dividends daily in increased efficiency of every worker.

Each of the many models and types available for all kinds of jobs has been scientifically designed to relieve unnecessary fatigue. At the same time each has been built for lifetimes of service—without developing the "rocking chair blues" so common in ordinary stools.

Fig. 1267

We have a catalog waiting for you which describes and illustrates our full line of "Hallowell" Stools and Chairs. Write for it now and select the models that will solve the seating problems in your office and plant.

Fig. 1249
Pat. App. for

STANDARD PRESSED STEEL CO.

BRANCHES
BOSTON
DETROIT
INDIANAPOLIS

JENKINTOWN, PENNA.
Box 546

BRANCHES
CHICAGO
ST. LOUIS
SAN FRANCISCO

over-running clutch. Isothermic overload relay, working on heater and bi-metallic strip principle, may be set for either manual or automatic resetting after overload. A blowout and arc chute on the line contact is included in the multifinger contactor. Starters may be applied to constant-speed motors up to 1,800 r.p.m. that require no more than 150 per cent of full-load torque to start, nor longer than 10 sec. to attain full speed, it is claimed. General Electric Co., Schenectady, N. Y.

Spool and Clevis

Three-in. spool and clevis assembly, using spool insulator, is suitable for secondary racks. The insulated clevis, made of hot-dip galvanized steel, is for dead-ending secondaries and neutral conductors, turning angles, etc. The spool is made of wet-process porcelain. It has a tapered hole for even distribution of loads and for reducing spool breakage in case of deflection under a heavy mechanical load. Ohio Brass Co., Mansfield, Ohio.

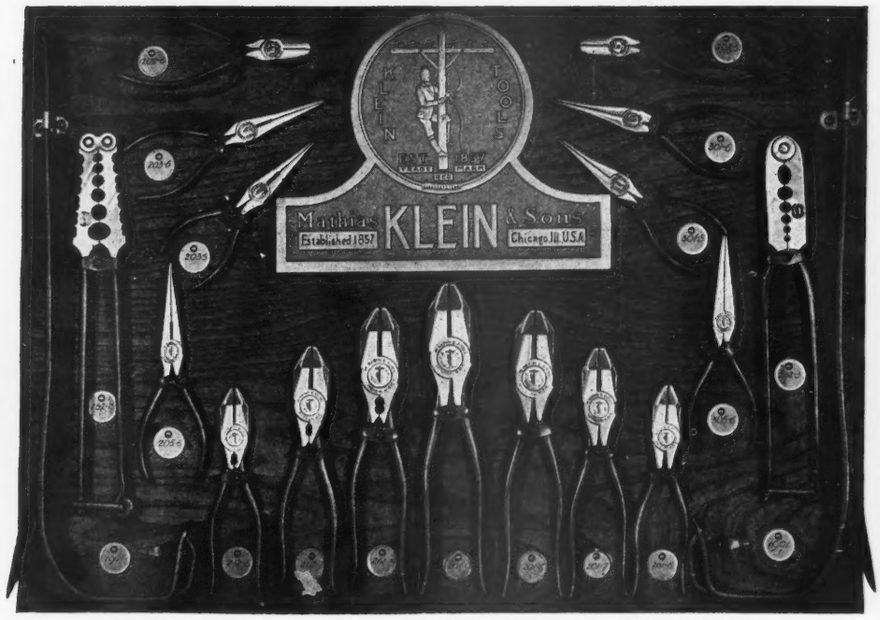
Lamp Transformers

Indoor-type transformer is rectangular in shape for wall or post mounting with brackets. Terminals are made accessible by small doors at top and bottom. Weatherproof pole-mounting transformers have terminals accessible at bottom, and 3-threaded hubs so that up to 3 fixture-mounting supports may be used. Both types serve two 400-watt mercury lamps. Jefferson Electric Co., Bellwood, Ill.

Sight Glasses for Pipe Lines

Close fitting, equipped with sight glasses for visual inspection of flow of liquids and sludge through pipe lines and for determination of duration of backwash for filters and zeolite softeners (thus eliminating necessity of discharge to an open

Electrician's and lineman's tools, typical of complete line manufactured by Mathias Klein & Sons.



COMPLETE PRODUCTION CONTROL FOR 16 YEARS* *with* McCASKEY

*In September 1924, the following statement by Mr. J. A. Klein, Jr., Superintendant of Mathias Klein & Sons, Chicago, appeared in a McCaskey advertisement in "Factory":

> "About eight months ago, we installed McCaskey methods to accurately control production, payroll, costs and stock. Formerly we used time consuming hand posting. McCaskey cuts down the record work about 30% and gives us up-to-the-minute records. In our work, each job has from 3 to 50 operations and the status of each operation now is available at a glance."

Today after 16 years of peak and depression requirements, the original controls still provide control of work-in-process by as many as 50 operations; perpetual inventory of raw material, process and subassembly stock; and payroll, costs and labor distributions—and all without a bit of red tape or delay. Changes in detail have been made, for McCaskey Controls are extremely flexible and adaptable. But the basic principles have not been altered.

Hundreds of manufacturers are using McCaskey methods, equipment and factory forms to tighten up various controls of production. McCaskey Control may be the answer to some of the excessive costs or delays that are bothering you now. And, they do not require a big investment. Let us give you more facts concerning their application to your specific requirements.

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

DRIVE PHILLIPS Recessed Screws with "YANKEE"

QUALITY SCREW DRIVERS

—Two Styles—
HEAVY DUTY
and
REGULAR

HEAVY DUTY
No. 901–1 Point
No. 902–2 Point
No. 903–3 Point
No. 904–4 Point

REGULAR
No. 941–1 Point
No. 942–2 Point
No. 943–3 Point
No. 944–4 Point

"YANKEE" PHILLIPS BITS
for use in all
"YANKEE" SPIRAL SCREW DRIVERS

PHILLIPS LIC. 3 Patent Nos. 2046837-2046840-2066372.

"Yankee" Phillips screw driver blades and bits are of special alloy steel; the best obtainable for the purpose. They are hardened and tempered to the proper degree for the driving of Phillips Screws, including the sheet-metal, self-tapping types of screws which are being used very extensively.

Write us for further details.

NORTH BROS. MFG. CO.
Dept. F Philadelphia, U.S.A.

funnel or sump for inspection), permits observation of fluid in flow under pressures up to 125 lb. per sq. in.; permits discharge of sludge to sewer under pressure; and permits smaller line than would be necessary with gravity flow from an open funnel; it is claimed. Designed for 2½-, 3-, 4-, 5-, 6-, and 8-in. lines. Body is cast iron; window frame is steel; windows are Pyrex glass. All sizes measure 13¼ in. between finished surfaces and 4¼ in. in diameter of windows. Weights range from 45–215 pounds. Cochrane Corp., 17th St. & Allegheny Ave., Philadelphia.

Selenium Rectifiers

Type SR rectifiers, for such d.c. applications as magnetic chucks and clutches,

lifting magnets, machine tools, circuit breakers, solenoid valves, are normally furnished with d.c. voltmeters and ammeters. Selenium plates compose the rectifying medium. For a given voltage-current output, fewer plates and plates of smaller size are required, it is said. The rectifiers are manufactured to order in full-wave-bridge or half-wave types for d.c. voltage and current output. The elements, transformer, fuses, and controls are mounted in ventilated steel cabinets. Control is through dial tap switches. Fansteel Metallurgical Corp., North Chicago, Ill.

Gyro-Electric Sander

Portable, electric, air-driven sander, that can be plugged into any socket, has a self-contained, gear-driven, electric motor. Motion of the flexible sanding pad closely simulates hand-sanding motion, it is claimed. Abrasive paper, measuring one-fourth of a 9x11 sheet, when attached to the sanding pad is held in place by a holder. Cloths can be attached in like manner for rubbing and polishing. Operating at 4,000 r.p.m., weighing 3½ lb., the machine can be operated by one hand. Sterling Products Co., 2457 Woodward Ave., Detroit.

Lighting Unit

Dust-tight and vapor-proof "armor-clad" lighting unit, for locations where smoke, grime, fumes, steam and moisture are present, is available in 2 types having multi-conical-section contour for lighting control. Highly polished, specular type is for high mounting installations; etched-surface

Available for PROMPT DELIVERY . . . Made in the U.S.A.

Whether you are a producer of steel or silk — or operate a department store . . . whether you ship rugs, bolts of materials or fabricate a product that requires additional strength . . . if your problem is that of better wrapping or packaging, check the many advantages of FIBREEN.

Superior to burlap, jute or other imported material, Fibreen is made in the U. S. A. It is economical—involves no price troubles and no uncertain deliveries.

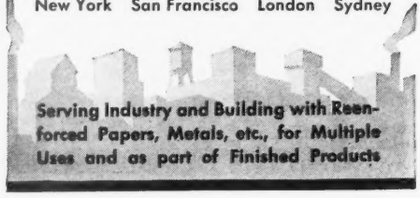
No Other Wrapping Material Has All These Advantages

- Strength
- Clean, Kraft Surfaces
- Easy to Apply
- Waterproof
- Keeps out Dust and Dirt
- Eliminates concealed Damage

Liberal Sample for Trial or Testing

A generous sheet or roll of Fibreen will be sent on request for trial or testing in any use you have in mind. Write and describe your problem.

The SISALKRAFT Co.
(Industrial Division)
205 W. WACKER DRIVE • CHICAGO, ILL.
New York San Francisco London Sydney



Serving Industry and Building with Reenforced Papers, Metals, etc., for Multiple Uses and as part of Finished Products

A Keg or a Carload . . . your order receives *"Scully Service"*

ALLOYS
ANGLES, HOT ROLLED and COLD ROLLED
ARCHES (CORRUGATED)
BABBITT
BANDS and HOOPS
BARS, HOT ROLLED
ALLOYS (HR and CF)
COLD FINISHED
ELECTRIC HIGH CARBON STEEL
REINFORCING
BEAMS and C. B. SECTIONS
BEEF RAIL
BOLTS, NUTS, WASHERS, ALL KINDS
BORING and TURNING BARS and GRINDERS
BRACES, BOILER
CHAIN, ALL KINDS
CHANNELS
CHISELS
CHUCKS, STAYBOLT
CLAMPS, BOILERMAKERS
CLIPS, PATTERSON
CLEANERS, FLUE
CONDUCTOR PIPE
COPPER and BRASS
COUPLINGS, HOSE
CRAYONS, SOAPSTONE
CUTTERS
DARDELET RIVET and MACHINE BOLTS
DRILL RODS
EAVE TROUGH and FITTINGS
EXPANDERS, FLUE
FERRULES, COPPER
FLANGES, BOILER and TANK
FLOOR PLATES
GALVANIZED SHEETS, BARS, BANDS, ETC.
HANDLES, HAMMER
HEADS, TANK and FLANGE
HOISTS, HAND and POWER
IRON, STAYBOLT
LUGS, BOILER, TANK and SILO
MACHINERY, HAND and POWER
MANHEAD PLATES and FITTINGS
NAILS
PACKING
PAINT STICKS
PLATE STEEL, STANDARD QUALITIES
ABRASION RESISTING
COR-TEN and MAN-TEN
PLUGS, FLUE
RAILS and FITTINGS
REAMERS
SHAFTING
SHEETS
ABRASION RESISTING
ELECTRICAL
COR-TEN and MAN-TEN
HOT ROLLED and UNIFORM BLUE
WELLSVILLE POLISHED
COLD ROLLED
STAINLESS STEEL
GALVANIZED and GALVANNEALED
LONG TERNE
CORRUGATED
U·S·S COPPER STEEL
SPRING STEEL BARS and SHEETS
STAINLESS STEEL
STRIP STEEL, CR and HR
TEES
TIRE, ROUND EDGE
TOOLS, HAND and POWER for BOILER and IRON WORK
TROLLEYS
TUBES, BOILER
TURNBUCKLES
VALVES, BLOW-OFF
WELDING ROD and WELDERS
ZEES

USS Scully Service

SCULLY ST. LOUIS WAREHOUSE

"Last Saturday we received a wire from the oil fields requesting immediate shipment of two kegs of Bolts for a break-down job and we made shipment that day."

SCULLY NEWARK WAREHOUSE

"Order for carload of C Beams received at 2 o'clock for use on railroad bridge damaged by flood — shipped same day at 4 o'clock."

BIG or little, your order always gets the same prompt attention from Scully. The Scully business and our famous reputation for quick, friendly, reliable service have been built by recognizing the simple fact that *every* order is equally important to our customers. All eight Scully Warehouses operate on the same principle . . . and our customers know that it pays to call Scully.

Phone, write or wire the Scully Warehouse nearest you the next time you need steel, steel products, copper and brass. Each carries large stocks available for immediate shipment. And ask for a copy of our Stock List and Reference Book—it's free.

SCULLY STEEL PRODUCTS COMPANY

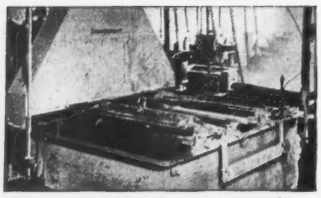
Distributors of Steel, Steel Products, Copper and Brass

CHICAGO · NEWARK, N. J. · ST. LOUIS · BOSTON · ST. PAUL—MINNEAPOLIS
CLEVELAND · PITTSBURGH · BALTIMORE

UNITED STATES STEEL

JOE, YOU'RE NOT LOOKING SO GOOD LATELY

"No, Cora, I have been feeling rotten. I think it's those fumes at the plant."



Sturtevant Exhaust System for cyanide tank.

Sturtevant Grinder Exhaust System for carrying off emery and steel dust from grinding operations.

A HEALTH HAZARD such as this calls for *action.* Delay is likely to result in sad and costly consequences.

No matter whether your problem is one of removing fumes, dust, steam, or excess heat—Sturtevant can design a system for you which will effectively remedy the trouble.

Sturtevant Dust and Fume Removal Systems offer you many advantages. They assure you of a system exactly suited to your particular requirements—skilfully engineered—backed up by over 75 years of air engineering experience.

Write, briefly explaining your problem, and your inquiry will receive immediate attention.

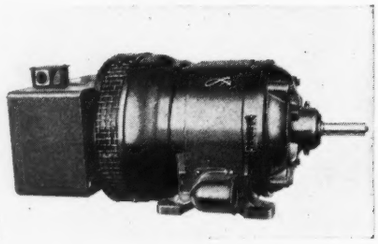
B. F. STURTEVANT COMPANY
Hyde Park, BOSTON, MASS. *Branches in 40 Cities*
B. F. Sturtevant Company of Canada, Ltd.
Galt, Toronto, Montreal

Sturtevant
REG. U. S. PAT. OFF.

Puts Air to Work

FOR DUST AND FUME REMOVAL

spread-type distribution is for medium mounting heights. Lamps from 750-1,500 watts are used. Housing is drawn from heavy-gage metal, finished in a fused-to-metal coat of porcelain enamel covered with acid-resisting, baked-on, synthetic enamel. The glass cover is said to be unaffected by extreme temperature changes, to be impact resistant—resistant to 1½-lb. ball dropped from 7 ft., and to break into blunt fragments when shattered. A cast-aluminum hinged cover frame locks the glass and gasket to the housing. Reflectors are removable. Benjamin Electric Mfg. Co., Des Plaines, Ill.



Adjustable-Speed Motor

"Ajusto-Spede" motor, combination eddy-current clutch and standard constant-speed a.c. squirrel-cage motor, performs such functions as gradual or quick acceleration of load, rapid intermittent starting and disconnecting of load, absorption of tortional impulses and vibrations without jar, shock, or stress on driven parts, it is claimed. There is said to be no mechanical contact between the driving and driven members of the unit. Speed and torque variations are obtained by controlling magnetic excitation of the clutch. Features claimed: Wide range of speed variation from zero to full speed at full-load torque; continual operation at low speeds without overheating; remote control available (at extra cost). Typical applications: printing presses, feed and working drives on machine tools, tension drives, wire-drawing machinery. The Louis Allis Co., Milwaukee.

Circuit Breaker

A 15-, 20-, and 25-amp. multi-breaker is a small-size surface-mounting-type switching device for overload protection of appliances, lighting, etc., that measures 6⅛x4x2⅞ inches. It is furnished in 3 types: For 2-wire solid neutral 115-volt a.c., 1 or 2 single poles, grounded or solid neutral; for 3-wire solid neutral 115- and 230-volt a.c., 1 double pole or 2 single poles, grounded or solid neutral; for 2-pole 115- and 230-volt a.c., one double pole, no neutral. Westinghouse Electric & Mfg. Co., East Pittsburgh.

Reflector

"Para-Sphere" gold-plated reflector (combination paraboloid and sphere), for accommodation of infra-red ray lamps, is equipped with an adjustable porcelain socket. The reflectors are supplied in single-reflector units and in strips of 4, 5, 6, and 7 reflectors. Strips are of 2-piece design to facilitate wiring and

(*Continued on page* 120)

KOPPERS

No postage required

Tear out

Check off the ones you want

Drop in the mail

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 1046, SEC. 510 P. L. & R., PITTSBURGH, PA.

KOPPERS COMPANY

108 KOPPERS BUILDING

PITTSBURGH, PENNA.

MAIL THIS CARD FOR YOUR COPIES

FREE

PRODUCT INFORMATION

KOPPERS

Specifications

BUILT-UP ROOFING

WATERPROOFING

DAMPPROOFING

FLASHING

ROOF INSULATION

KOPPERS COMPANY • PITTSBURGH • PENNSYLVANIA

This booklet tells . . .

How to get longer-lasting roofs.
How to use the roof to keep a building cooler.
How to prevent leaks in foundations.
How to waterproof all types of construction.
How to prevent water penetrating building walls.
How to prevent decay of wood floors in basements.
How to waterproof sidewalk vaults, shower-baths, tunnels between buildings.
Use the postcard to send for your copy. Free.

SEE OTHER SIDE

KOPPERS COMPANY, Pittsburgh, Pa.

Please send me the following product information:

- ☐ Koppers Roofing and Waterproofing Specifications
- ☐ Koppers Coal Tar Roofs on Steep Pitches
- ☐ Spray Pond or Flooded Roofs
- ☐ Maintenance Bonds on Koppers Roofs
- ☐ Koppers Membrane Waterproofing
- ☐ Koppers Dampproofing
- ☐ Waterproofing Deep Foundations
- ☐ Waterproofing Sidewalk Vaults
- ☐ Waterproofing Tunnel to Connect Buildings
- ☐ Waterproofing Shower Baths
- ☐ Waterproofing Indoor Swimming Pool
- ☐ Bituminous-base Paints and Coatings
- ☐ Industrial Boiler Plants
- ☐ Industrial Electric Power Stations and Electrical Contracting
- ☐ Design and Construction Service
- ☐ Material-handling Engineering Service
- ☐ Material-handling Systems for Stone, Sand, Ore, etc.
- ☐ Pressure-treated Roof Decks, Flooring, Siding
- ☐ Pressure-treated Timber for Company Houses and Office Buildings
- ☐ Pressure-treated Foundation Piling
- ☐ Pressure-treated Poles
- ☐ How to Measure Effectiveness of Pressure Treatments of Timber
- ☐ How to Order Piston Rings
- ☐ Piston Rings for Compressors
- ☐ Piston Rings for Bearings
- ☐ Piston Rings for Hydraulic Presses
- ☐ Piston Rings for Diesel Motors
- ☐ Proper Piston Rings to use for Re-bore, Re-Ring, Re-Claim Jobs
- ☐ Coals for the Gas Plant
- ☐ Coals for Power Plants, Bunkers, Smithies, Processing, etc.
- ☐ Coals for Stokers
- ☐ Coals for Domestic Use
- ☐ Self-aligning Couplings
- ☐ Carpenter Centrifugal Driers for Dewatering Granular Materials

Your Name .....

Title .....

Address .....

USE THIS POSTCARD TO SEND FOR . . . YOUR FREE COPIES OF THESE FOLDERS

KOPPERS

KOPPERS COMPANY • ENGINEERING & CONSTRUCTION DIVISION • PITTSBURGH, PENNSYLVANIA

These folders tell . . .

How to have your steam and electric power requirements studied.

How to determine whether you need new boiler capacity.

How to get better results and more efficiency in your steam boiler installations.

How to look for possible savings in power costs.

Use the postcard to send for your copies. Free.

These folders tell . . .

How to eliminate scuffing in compressors; how to reduce wear on piston rings and cylinders; how to prevent "blow-by."

How to get longer piston ring life on hydraulic presses.

How to choose piston ring set-ups for Diesel engines where there are overload conditions, or ring sticking, "port-clipping," etc.

Use the postcard to send for your copies. Free.

KOPPERS

THE WOOD PRESERVING CORPORATION • PITTSBURGH • PENNSYLVANIA

This folder tells . . .

How to get longer life from your timber structures.

How to prevent termite damage.

How to prevent decay.

How to figure costs and savings in use of pressure-treated timber.

Which types of timber to use for various industrial construction work.

Use the postcard to send for your copy. Free.

KOPPERS

KOPPERS AMERICAN HAMMERED PISTON RINGS
FOR COMPRESSORS
GOLD SEAL PISTON RINGS*
SILVER SEAL RINGS*
KOPPERS COMPANY • AMERICAN HAMMERED PISTON RING DIVISION

These folders tell . . .

How to select the best coals to cut maintenance costs of stacks, flues, etc.

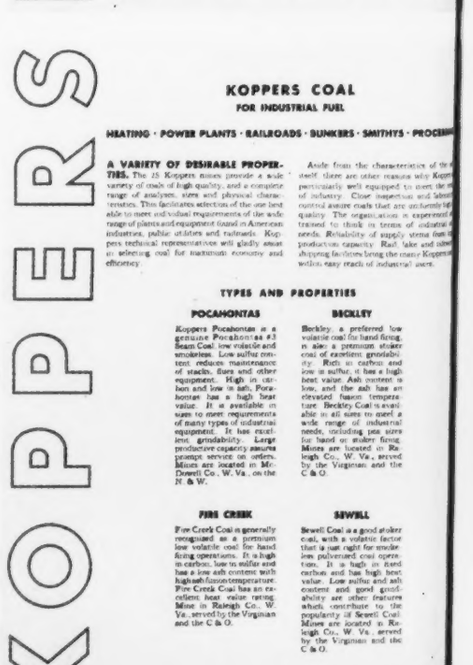
How to select coals for powdered fuel processes in which ash would harm the product.

How to select a coal for conditions where high efficiency, low maintenance and freedom from smoke are required under variable load conditions.

How to select best coals for various other special purposes.

Use the postcard to send for your copies. Free.

KOPPERS

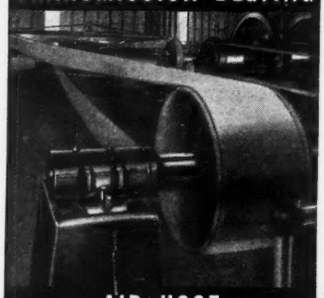


HERE ARE SEVEN TYPICAL SHEETS

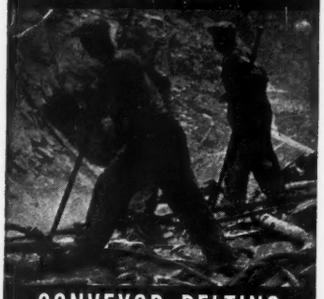
THE Thermoid LINE

SHORTEST DISTANCE TO OPERATING ECONOMY

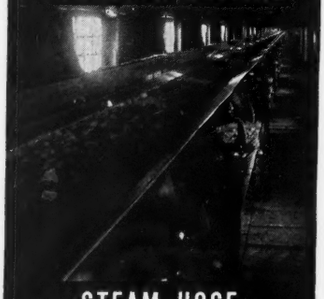
TRANSMISSION BELTING



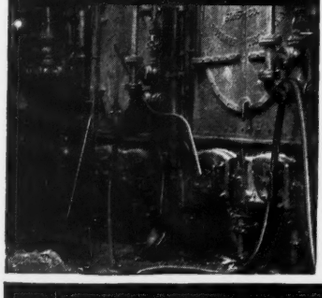
AIR HOSE



CONVEYOR BELTING



STEAM HOSE



PRODUCTION and maintenance men in all types of industry know from experience that Thermoid Products are developed and manufactured with a practical engineering knowledge of the job each particular product has to perform.

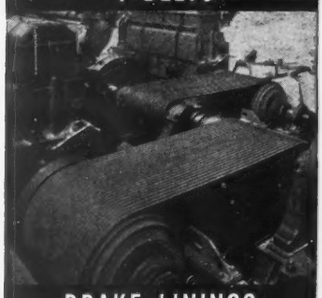
They know, too, that Thermoid's rigid adherence to this policy, plus the use of only the finest raw materials, guarantees a product dependability that leads directly to operating and maintenance economies.

For operating economy specify and use Thermoid Industrial Rubber Products. Thermoid also welcomes requests for engineering consultation on individual problems at all times.

★ *More than half a century of Progressive Engineering and Product Development* ★

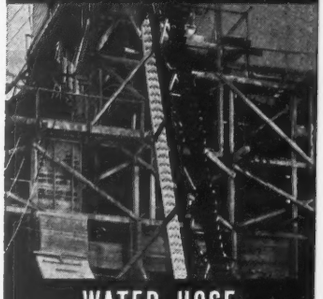
THERMOID RUBBER, DIVISION OF THERMOID CO., Trenton, N.J.

V BELTS



BRAKE LININGS

ELEVATOR BELTING



WATER HOSE

Standard types of belting made by Thermoid:
Transmission Belting
Conveyor Belting
Multiple V Belts
Grader Belting
Canners' Belting
Bucket Elevator Belting

Standard types of hose made by Thermoid:
Air Hose
Water Hose
Steam Hose
Tank Truck Hose
Gasoline Hose
Suction Hose

Thermoid

BELTING · HOSE · PACKINGS · BRAKE LININGS

The BROWNING CRANE & SHOVEL Co.

ESTABLISHED 1899

Main Office and Factory

16226 Waterloo Rd., Cleveland, Ohio

Export Department

30 Church St., New York, U. S. A.

40 YEARS OF LEADERSHIP

RAIL CRANES SHOVELS DRAGLINES ZEE ROTATORS

BROWNING PRODUCTS

DIESEL GASOLINE STEAM ELECTRIC

CRAWLER, TRUCK AND WAGON SHOVELS DRAGLINES CRANES • HOES

BROWNING PRODUCTS

DIESEL GASOLINE STEAM ELECTRIC

here! there! everywhere!

dag COLLOIDAL GRAPHITE BEATS HEAT

FOR STEAM CYLINDERS

FOR COMPRESSORS

FOR HIGH TEMPERATURE LUBRICATION

. . . . in conveyors and baking ovens, in die casting and permanent mold equipment, in ceramic and glass making machinery, in new places every day.

This material is now available in a form that permits stable suspensions, even in low viscosity fluids such as kerosene, spindle oils, etc. Where boundary conditions exist, "dag" colloidal graphite acts as an ideal teammate for oil. In the presence of high temperatures, dispersed in fluids that quickly evaporate, only a positive, clean, durable lubricating film of graphite remains on the bearing surface. It takes over the load at the point where oil leaves off.

Send for brochure describing the properties of "dag" colloidal graphite and 182 uses in industry. You or your oil supplier can easily add "dag" to your present lube or to selected petroleum fluids.

dag COLLOIDAL PRODUCTS

ACHESON COLLOIDS CORPORATION

PORT HURON, MICHIGAN

(*Continued from page* 116)

mounting. The Fostoria Pressed Steel Corp., Fostoria, Ohio.

Air-Cooled Transformers

Applications for air-cooled transformers, for use in lighting and power circuits, rated 1 v.a. to 10 k.v.a., 50 and 60 cycles, include operation of portable tools at non-standard voltages, low-voltage lamps from standard input circuits, signal-control equipment from standard lighting circuits. Ferranti Electric, Inc., 30 Rockefeller Plaza, New York.

High-Lift Trucks

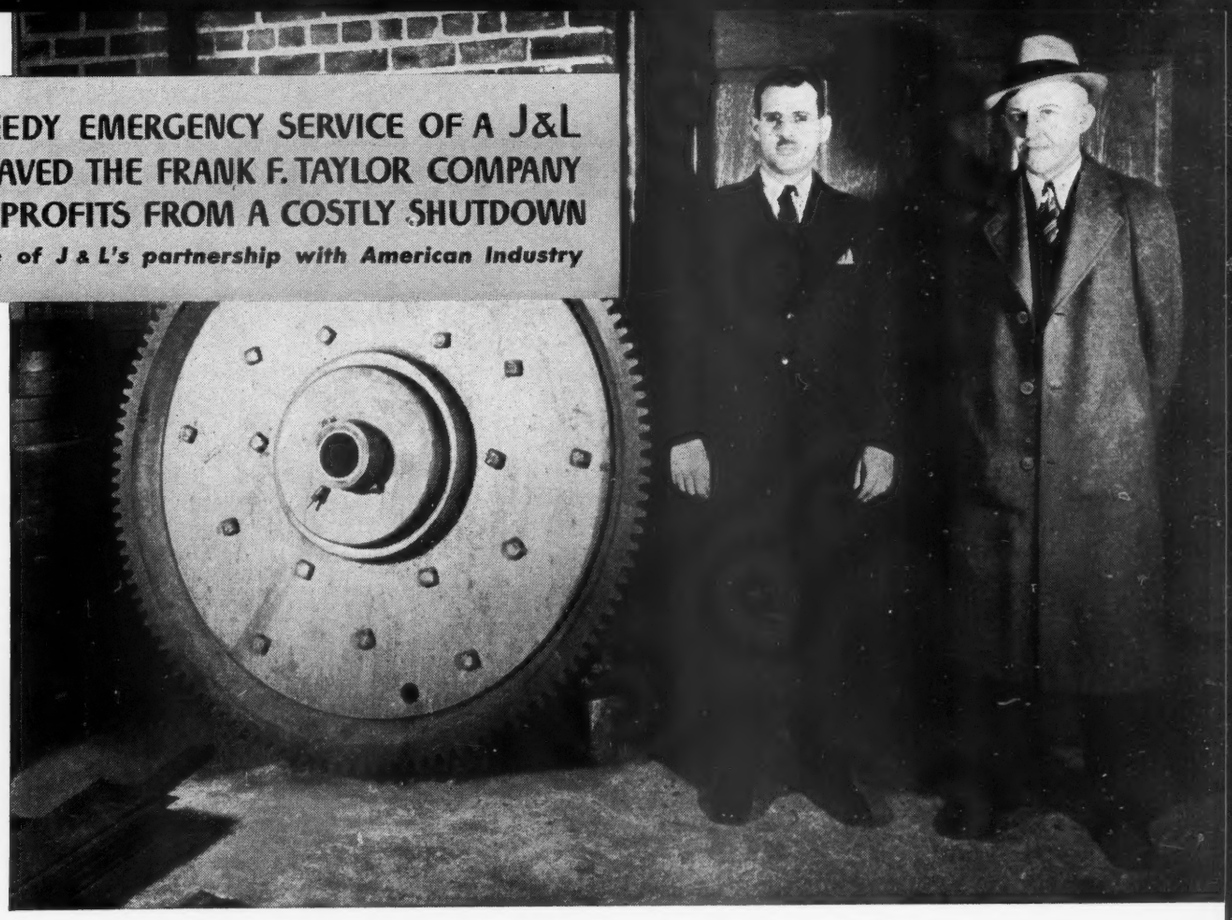
"Midget" high-lift trucks, said to contain no "midget" parts, are available in 1½- and 2-ton capacities—the former having a single trailing axle, the latter a fully compensating tandem trailing axle. Standard platforms are from 18–36 in. wide, 48–72 in. long, and 7 in. high in lowered position. Tiering models, non-telescoping lifts, are available up to 10 feet. A telescoping feature may be had for extreme lifts with low over-all height. One variation is a low-lift model in which platform lifts to 23 in. above floor; another has platform 9 in. high in lowered position. Hoist controller operates pump motor and valve to lifting jack cylinder, and lowering by gravity is under control of operator. Travel speeds up to 6 m.p.h., lifting speeds up to 20 ft. a minute. The Baker-Raulang Co., 2168 West 25th St., Cleveland.

Disconnecting Switches

Indoor disconnecting switches, for hookstick or group operation, are available in ratings of 200-6,000 amp. for 5,000-volt service, and 400-6,000 amp. for 7,500- to 34,500-volt service. Features a multiple-line-pressure-area contact consisting of 30 silver-coated "sled runners" 0.005 in. wide on each blade. Distributed over 2 rectangular areas, about ½ by ¾ in., the contacts resemble screw threads on a flat surface. Operation is said to "wear in" line contacts thus increasing contact area. Operating eye and blade latch have been designed to produce a cam or pry-out action which is said to disengage the blades from the tongue member thus facilitating opening the switch. Other features include a spring-cup washer and locking device, and an adjustable safety blade stop. Westinghouse Electric & Mfg. Co., East Pittsburgh.

HOW THE SPEEDY EMERGENCY SERVICE OF A J&L WAREHOUSE SAVED THE FRANK F. TAYLOR COMPANY THE LOSS OF PROFITS FROM A COSTLY SHUTDOWN

Another example of J & L's partnership with American Industry



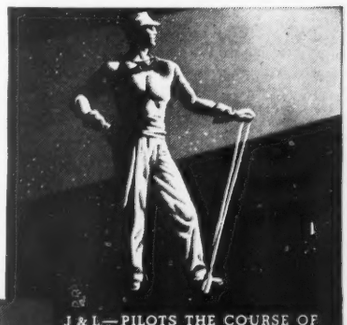
A plant operating full time — to fill immediate orders — then a fly-wheel cracks, causing what looked like a serious production delay. Mr. W. N. Muchmore of The Frank F. Taylor Company, Cincinnati, Ohio, writes as follows telling how the prompt cooperation of the J & L Cincinnati Warehouse helped him out of this difficult situation:

"During our extremely busy season, we had the misfortune of having a fly-wheel crack on one of our important Punch Presses. In order to keep this press operating until a new fly-wheel could be obtained it was necessary to repair the cracked fly-wheel. This required two pieces of $\frac{5}{8}$-inch thick hot rolled steel $61\frac{1}{2}$ inches outside diameter and $22\frac{1}{2}$ inches inside diameter. The fly-wheel cracked at 8 P.M. and we needed the steel by 7:30 the next morning to keep the press running and our plant in production.

"We called our J & L representative, Mr. Guethlein, at his home about 9 P.M. and told him what we needed and when delivery must be made to our plant. Without hesitation, Mr. Guethlein said 'You will have it by 7:30 tomorrow morning.'

"Thanks to Mr. Guethlein and the Jones & Laughlin Warehouse the steel was delivered to our plant before 7:30 the next morning and in a very short time the press was operating again."

You never know when you, too, may be faced with an urgent problem which your J & L Warehouse can help solve — the need of the right kind of steel in a hurry. You can be sure your J & L Warehouse has it among its stock of Controlled Quality Steels. The J & L Warehouse in your vicinity is amply equipped to supply your smallest or largest requirements — quickly, promptly and efficiently. Do as so many progressive manufacturers do — just pick up your telephone and call your J & L Warehouse.



J & L—PILOTS THE COURSE OF CONTROLLED QUALITY IN STEEL

J & L WAREHOUSES

PITTSBURGH	CINCINNATI	DETROIT	NEW ORLEANS	CHICAGO
26th and Jane Sts.	5th and Vine Sts.	3289 Beaufait Ave.	No. Miro and Japonica Sts.	2250 W. 47th St.
Hemlock 1000	Main 2324	Plaza 0470	Franklin 1131	Virginia 1600

NEW YORK: 30-44 Review Ave., Long Island City . . . New York City, IRonsides 6-8700 . . . Jersey City, Bergen 4-2994 . . . Newark, Market 3-2994

MEMPHIS: 1 Auction Avenue — 5-1625

J&L STEEL

For every need—The right quality of steel in a full range of sizes

J & L — PARTNER IN PROGRESS TO AMERICAN INDUSTRY

Payroll Reporting Made Easy

(Continued from page 45)

totals are shown at the bottom of the employee's ledger sheet—on an accrual basis for internal revenue reporting. These yearly totals, therefore, are not a sum of the four quarterly subtotals, because the amount of wages accrued in the week at the beginning of the year must be subtracted and the amount accrued in the last week of the year added.

Additional difficulty was offered when the unemployed reserve section of the federal social security tax was put on an accrual basis, as contrasted to the old-age section which was and is on a cash basis. The 1939 amendments, however, change the unemployment reserve portion to a cash basis effective January 1, 1940, making it uniform with the old age section. Most state unemployment reserve laws are being amended to conform to this basis.

Nevertheless, this tax is not involved in keeping individual employee's earnings records, because the tax is paid on the entire payroll (or the amount in excess of $3,000 per year) and is not dependent on the records of individuals.

A requirement of the Social Security Act Amendments of 1939 is that beginning with January 1, 1940, a receipt or statement of earnings and deductions, containing certain information, must be furnished to each employee. Another amendment provides that the statement must be made quarterly or at no longer intervals than annually. However, if desired, the statement can be given to the employee each time wages are paid. This seems to be the simplest procedure.

The law provides that the statement must show the name of the company, name of the employee, total earnings, social security tax deductions, and the period covered by the statement or the date the wages were paid, if a statement is furnished on each payday. For many years a considerable number of firms have provided their employees with stubs to be torn from their paychecks, showing how the net amounts of the checks were arrived at.

Evidence of Earnings

In only a few cases is the information specified by the new law on the old stub. Usually lacking are the employee's and employer's names. It seems that the purpose of the new requirements is to provide the employee with some evidence as to his earnings in case of any controversy he may have later with the social security records in Washington.

The statement shown in the sample form provides for all these requirements. It is rather an awkward shape for the employee to keep, but since the employee's name must appear, this is the only form that can be filled out by bookkeeping machine in one operation.

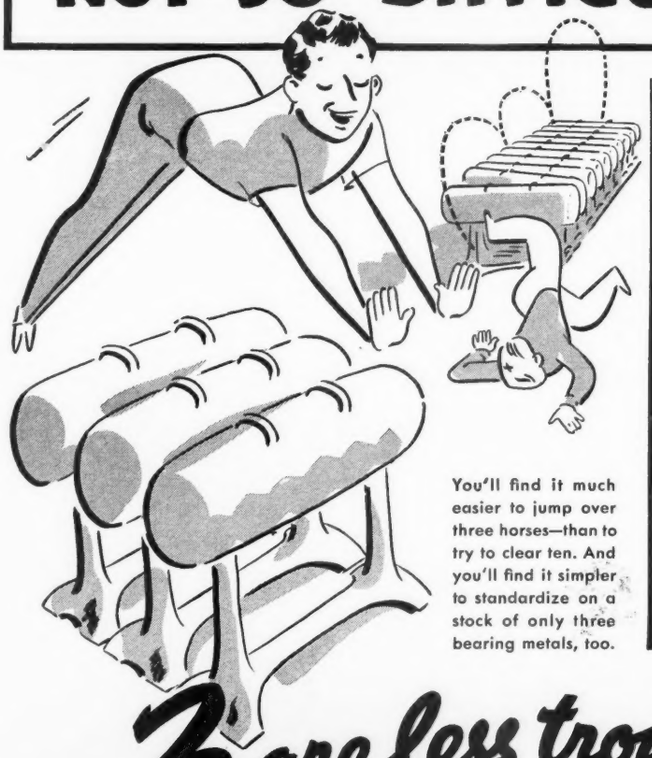
Where the payroll is not to be kept on the bookkeeping machine but as a pen record, the same form can be used. An improvement can be made in the shape of the employee's statement, since there is not the limitation that all data must be listed on the same horizontal line. The statement form can be shortened considerably and the information listed on several lines.

For pen records it is not unusual to omit entirely the preparation of a journal sheet or check register. On the other hand, the employee's earnings ledger sheet is most essential, and for hand recordings it should be provided with vertical rules for each digit so that totalizing is an easy and accurate task.

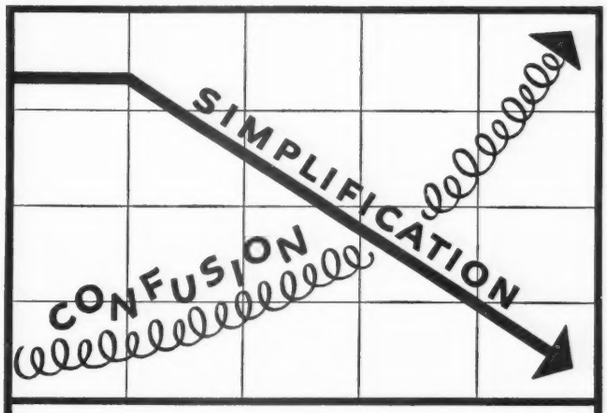
Many concerns have been in a quandary since the passage of the Wage and Hour Law as to just what records were required in connection

PRECISION
maintained!
"MONARCH" LATHE—Metered feed to ways, cross slide, apron bearings . . .
● High standards of machine accuracy, versatility and speed become of maximum value only when they are MAINTAINED. Bijur-lubricated machines are protected for life! Bearings, slides, gears . . . to each Bijur-fed part goes the metered oil-film it individually needs. Automatically! For a day's bigger output of higher quality work . . . for savings on maintenance . . . standardize on BIJUR.
BIJUR LUBRICATING CORPORATION, Long Island City, New York
1330
BIJUR
AUTOMATICALLY Correct LUBRICATION
The correct oil film to each individual bearing... automatically

NOT-SO-DIFFICULT DECISION



You'll find it much easier to jump over three horses—than to try to clear ten. And you'll find it simpler to standardize on a stock of only three bearing metals, too.

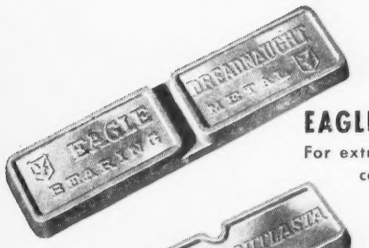


Operating Costs go down when purchases of Bearing Metals are simplified. Costs go up when a large assortment of Bearing Metals leads to confusion.

3 are less trouble than 10!

THESE 3 EAGLE *Bearing Metals*

Meet most Bearing Metal Requirements



EAGLE DREADNAUGHT
For extreme speed and pressure conditions

EAGLE OUTLASTA
For medium speed and pressure conditions

EAGLE DURABLE
For low speed and pressure conditions

EAGLE LEAD WOOL *plugs off bottom water pronto.* Eagle Lead wool is soft and pliable—under tamping pressure becomes a solid, secure plug. Seals tiniest crack. Always have a supply on hand. Saves costly shutdowns.

EAGLE *Controlled Specifications*

End Bearing Metal Troubles . . .

Costly shutdowns are minimized . . . trouble-free operation is assured . . . when you rely on Eagle Bearing Metals. These metals are alloyed under strict pyrometric control . . . of clean, primary metals. Eagle Controlled Specifications guarantee uniformity and long life. Eagle Bearing Metals contain no hard spots to cut and score the shaft. Sold through recognized distributors. Write today for free booklet.

EAGLE EP PICHER **THE EAGLE-PICHER LEAD COMPANY · CINCINNATI, OHIO**

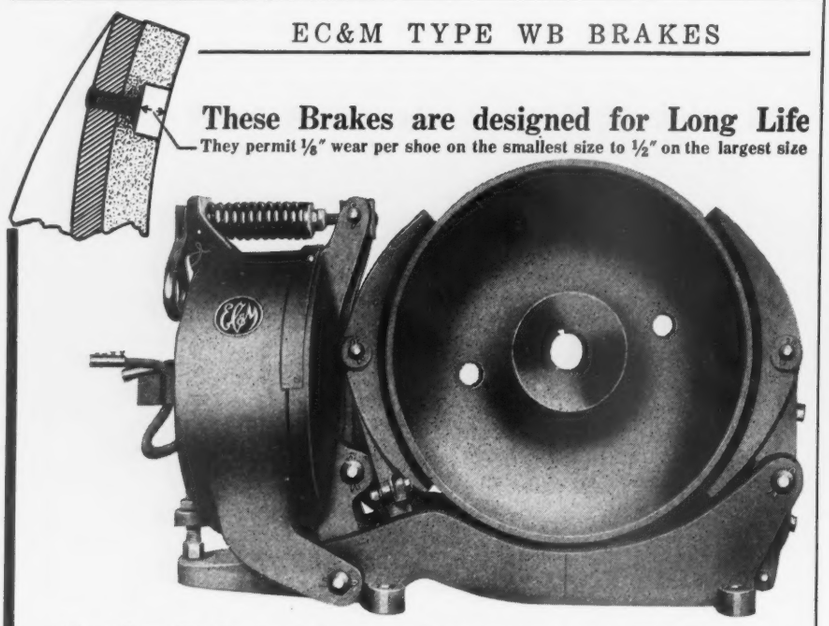
with salaried workers. Regulations of the administrator definitely state that records of hours worked each day and each week must be kept even for the salaried workers.

Really the only way to keep an accurate record of office workers' hours is to put a timeclock in the office. But this is often undesirable. A sample form is shown here which is intended to take care of this difficulty. This form is made out daily by the office manager or by each department head having salaried employees reporting to him. The regular established hours of the department are listed. Then all employees who comply with the established hours for that particular day do not appear at all on the report. Those employees who worked less than the specified hours or who were absent for any cause, including vacations, accidents, and sickness, are listed in the place provided with the reason noted. Similarly, all employees who worked more than the established hours are listed along with the reasons for their overtime.

This form requires a minimum of reporting. Although the requirements of the law and the regulations as to necessary records of salaried workers are somewhat vague, it appears that this form will fully meet them.

The new records must be in effect by January 1, 1940, or else your company will be subject to a penalty as provided in the 1939 Amendments to the Social Security Act.

EC&M TYPE WB BRAKES



These Brakes are designed for Long Life

They permit ⅛″ wear per shoe on the smallest size to ½″ on the largest size

No other Brake permits such long wear as the Type WB

Other Exclusive Features

MANUAL RELEASE for EMERGENCY OPERATION—The handle-nut shown in the upper left-hand corner of the above illustration of the WB Brake permits easy compression of the operating-spring to remove pressure of the brake-shoes from the brake-wheel — an advantage of outstanding merit when changing brake-shoes, checking the clearance between shoes and the brake-wheel, removing motor armatures or for lowering a load under manual control in emergencies.

No Rods or Levers over Top of Brake Wheel—EC&M Type WB Brakes are radically different from any other brake in that no levers, rods or other parts of the brake pass over the top of the brake-wheel, thus allowing motor-armature-replacement without dismantling the brake or disturbing any adjustments.

Study the design of this brake to learn why **"The Trend is toward EC&M Type WB Brakes".** Bulletin 1004-B gives the complete facts. Write for your copy today.

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS

My One-Man Poll of Worker Opinion

(*Continued from page* 38)

blood poison. Next week—doctor cut off t'ree time! Now no feet!"

But whether with worker literate or illiterate, union or non-union, management's job remains the same—to *reduce his need of unreasonable, non-cooperative, third-party advocates.* That, in turn, still requires two things—good management (for avoiding discrimination in rates, lay-offs, promotions, etc.) and contact (for discovering and remedying grievances quickly).

Unfortunately, for the general well-being, this further observation has to be reported—that the net result of the new wage and hour laws, NLRB policies, social security bookkeeping, and various other similar requirements in the national program of general bedevilment for the industrialist, is to make management look upon the hiring of brand new employees as almost the last desperate resort.

In conclusion, I'm still optimistic about our country and its future.

The Reds are in reality much less numerous than they appear. The chief trouble is that their policy of boring from within has made them give an immense amount of attention to labor unions—and, worse, to devote to their activities there an amount of training calculated to give to a very small number a total disproportionate amount of control.

But we have here, I am more than ever convinced, a more intelligent and better-informed, more reasonable body of workers than anywhere else in the world. It is only necessary that the members of this body be given time to learn the answers to their problems in the way most used by them—the way of daily, personal, individual experience. The greatest possible error is to refuse to grant them the lag inevitably required by this method as compared with the shorter, more usual, method of books and formal schooling.

One thing is plain. First, last, and all the time, these workers are people, individuals. They will long fight against any and all efforts to make them members of *any* class, most of all of any *working* class. This goes for every one of them from top to bottom. Every last

Here *Comfort* and *Economy* Walk Hand-in-Hand ON FLOORS OF NORTHERN HARD MAPLE

The Mathews Cotton Mill, Greensboro, S. C., floored with Northern Hard Maple

You cut costs "from the ground up" with Hard Maple —and it's easy to see why.

Watch workers—they show fatigue less quickly on resilient Maple, while its warm dry comfort and sanitation guards their health.

Watch machinery—Hard Maple creates no dust injurious to bearing surfaces.

Watch traffic—Both trucks and men move faster with less effort on this smooth-surfaced floor.

Watch monthly costs—for cleaning and for maintenance. Brushing alone keeps Maple clean. And Hard Maple wears smooth, does not sliver or splinter even under the wear of heavy, steel-castered trucks. Too, Hard Maple simplifies alterations, machinery shifting and renewal.

Watch wear—This flooring's famous for its long wear—its low cost per year of service.

Add these reasons and it's easy to see why scores of factories and mills use nothing but Northern Hard Maple—and, like the Mathews Cotton Mill above, find it *most satisfactory in every way.*

For Hard Maple at its finest, they make sure of *Northern* Hard Maple, by specifying trademarked **MFMA*** Flooring, in strips or blocks. *Ask your architect.*

MAPLE FLOORING MANUFACTURERS ASSOCIATION
1787 McCormick Building, Chicago, Illinois

• • •

See our catalog data in Sweet's, Sec. 11/77.
Write for leaflet on heavy-duty finishes for old or new floors.

* *The* **MFMA** *trademark, indented and stamped on Maple flooring, guarantees it to be* GENUINE *Northern Hard Maple, graded and* **MFMA** *supervised in accordance with the Association's exacting standards.*

Floor *with* MFMA Maple

REG. U. S. PAT. OFF

(NORTHERN HARD)

one wants to be approached and treated as an *individual*. The bummier the bum, the drunker the drunk, the more anxious he is to explain and justify himself as a self-respecting person. Above all, every soap-box preacher of "collectivism" discloses himself to any close observer as nothing less than a super-individualist!

This is today being threatened as never before by the country's attack on enterprises and its glorification of mere subsistence. But it still holds. As long as it continues to hold, we can, I submit, continue to retain our ancient faith in American democracy.

Organizing for Welding

(*Continued from page* 47)

portant factor is the transportation and handling of the materials used. Large plates and billets weighing many tons must be handled to and from raw material stock to shearers, shape cutters, benders, and seam preparation equipment. Fabrications consisting of many comparatively light parts must be moved from set-up tables to welding stations, handled for positioning at that point, then moved to cleaning and inspection positions and loaded on cranes or trucks for movement to machining and assembling departments.

A welding bay, to attain the highest efficiency, should be served primarily by an overhead cage-operated crane of sufficient capacity to lift the heaviest plates or billets used as raw material, or the heaviest assembly after fabrication. Each set-up table should have a floor-operated hoist, either jib or hoist-crane type, operating underneath the main runway.

Welders at the small assembly station should have jib cranes of sufficient sweeps to reach the work supply adjacent to their station. Often one jib can serve two or more welding stations, if the proper positioning equipment is furnished.

Positioning equipment is very important, and usually if it is used one cage-operated crane is sufficient to maintain efficient production. This is because many assemblies can be completely welded with one set-up if the welding positioner is so designed that the plate can be rotated 360 degrees, and if it can be tilted from horizontal to vertical position.

Another important group in the production welding shop is the sheet metal welding department. Here all sheet metal welding is done so that equipment can be maintained to handle one, and only one, class of work. While it is possible to weld light material on modern 300- or 400-amp. welding generators, it is poor economy on quantity production. Consequently all light and medium light welding is routed to the sheet metal division, except where excessive transportation would be the result.

The sixth and a very important division in the production welding shop is the salvage welding department. This department handles the welding of imperfect gray-iron castings rejected by the foundry inspection, the correction of machining errors, and the salvaging of obsolete parts. This division requires a highly skilled operator, in contrast to the other divisions where great experience is not absolutely necessary. The salvage welder must be familiar with all types of welding; where possible, he must be able to weld machined parts beyond machining limits without distortion. The welding generator must be of sufficient capacity to handle the largest electrodes used in production and also to use very small electrodes at low amperage.

The last group—the plant additions and maintenance welding department—is also important. Here, also, a highly skilled operator is needed, with equipment that can weld anything from light sheet steel safety guards to the

FREE!
OVERLOADED UNTIL THE STEEL TURING FAILED . . .
NOT A WELD LET GO OR EVEN CRACKED
HARD SURFACE YOUR CUTTING TOOLS
TEETH REBUILT BY WELDING
DENTISTRY FOR SPROCKET TEETH
HOW TO MAKE WELDED GEARS
HIGH CARBON STEEL
NEWLY WELDED SECTION
NEWLY WELDED SECTION PARTLY MACHINED
WORN TEETH BEFORE WELDING
OLD WORN SECTION
REBUILT BY WELDING

THESE HELPFUL WELDING HINTS!

Here's a timely series of suggestions, yours for the asking! Each is a proved, practical method of saving time and money in the type of welding work confronting you today! Ask to have your name placed on the list to receive them as they come off the press!

P&H SMOOTHARC

Welding Electrodes!

P&H engineers and users of P&H Smootharc Welding Electrodes have solved many welding "brain teasers" and applied the economies of welding on new types of work. Concise procedures are being sent to a wide group of welding men today. If your job is to watch costs in fabricating, rebuilding or maintaining equipment, you'll be able to use these P&H welding cards to good advantage! A post card is all you need. Just say, "Send me those Smootharc Welding Hints." Address the Harnischfeger Corporation, 4525 West National Avenue, Milwaukee, Wisconsin.

HARNISCHFEGER CORPORATION

WELDING ELECTRODES • MOTORS • HOISTS P&H ELECTRIC CRANES • ARC WELDERS • EXCAVATORS

VEEDER-ROOT COUNTERS

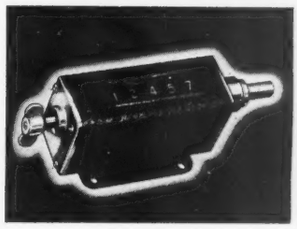
Tell how much work is done...

...in the Plant

The productiveness of every machine and operator can be accurately measured by Veeder-Root Counting Devices that can be made to count *anything*, in any terms or units. And these records . . . *fairly evaluated* . . . form a solid basis for the equitable administration of production, maintenance and wage systems. Two widely used Veeder-Root production counters are shown above at right.

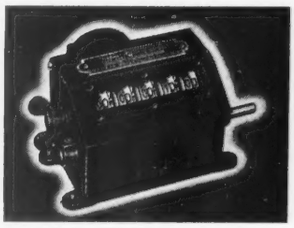
...in the Office

Measurement of stenographic, billing and accounting work becomes an exact science with Veeder-Root Counting Devices. Office workers are often given a *new incentive* to turn out better work and more of it. And work can often be distributed more efficiently . . . traffic can be made to move more smoothly . . . costs can be more closely controlled. Typical Veeder-Root Counters for office machines and appliances are the two lower ones in the panel above at right.



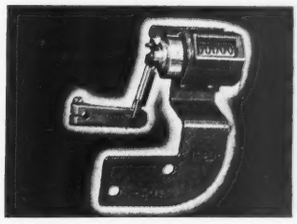
FOR HIGH SPEED WORK

This High Speed Resetting Counter operates at 8,000 counts per minute in direct-drive type . . . 2,000 counts per minute in revolution type. Subtracts when turned backward.



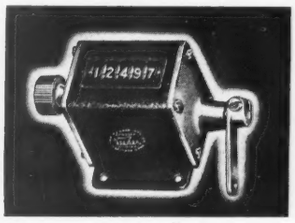
CONTROLS MACHINE RUNS

This Predetermining Counter is used in preventing over-runs and shortages on winders, fast automatics, etc., running up to 2500 r.p.m. Actuates mechanisms which shut down machines.



ACCOUNTING & TYPING

This Production Computator records each keystroke on typewriters and accounting machines, showing one figure for each 10, 100 or 240 strokes. Provides accurate basis of wage-payment and incentive systems.



FOR OFFICE AND LIGHT PRODUCTION MACHINES

Small Reset Counters count strokes or revolutions. May be furnished with totalizing register. Thumb lever and lock-and-key reset optional.

WRITE FOR BOOKLET: "TO COUNT IS TO CONTROL"

Veeder-Root Inc.

HARTFORD, CONNECTICUT

OFFICES IN Boston, Chicago, Cincinnati, Cleveland, Detroit, Greenville, S. C., Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Montreal, Buenos Aires, Mexico City, London, Paris, Tokio, Shanghai, Melbourne.

IN ENGLAND: VEEDER-ROOT LTD., CROYDON, SURREY
IN CANADA: VEEDER-ROOT OF CANADA, LTD., MONTREAL

Veeder-Root . . . TRADEMARK OF WORLD'S LARGEST MANUFACTURERS OF COUNTING AND COMPUTING DEVICES

heaviest work. Balconies, stairways, catwalks, repairs to cranes and crane runways, machinery repairs, and additions to existing buildings are welded under supervision of the department.

There, in brief, is the layout of a typical modern production welding shop. Of course, each plant presents its own problem, and its set-up would vary somewhat from this. But in the main, I believe, it would compare favorably with what we have here. At any rate, the basic difficulties to overcome are the same—to raise the welding operations to the highest degree of simplicity and to produce best welding possible.

BOOKS

1940 A.S.M.E. MECHANICAL CATALOG AND DIRECTORY

The American Society of Mechanical Engineers, 29 West 39th St., New York. 493 pages. $3.

Has a catalog section, alphabetically arranged, describing manufacturing and maintenance items used by industry; a classified directory of products; an alphabetical list of trade names; a 16-page catalog of A.S.M.E. codes, standards, periodicals, and other publications.

MANAGEMENT AND THE WORKER

F. J. Roethlisberger, Associate Professor of Industrial Research, Harvard Graduate School of Business Administration; William J. Dickson, Chief of Employee Relations Research Department, Western Electric Company, Hawthorne Works. Harvard University Press, Cambridge, Mass. 615 pages, illustrations, index. $4.50.

First full report of the 12-year collaborative research conducted by the Hawthorne Works of the Western Electric Company and the Industrial Research Department of the Harvard Graduate School of Business Administration to determine the effect of management's policies and practices on employees. Its aim is not to answer specific questions, but rather to present a development in the understanding of human situations which would help to improve employee relations and aid in resolving the problems arising in them when and where they occur. The five divisions of the book deal with working conditions and employee efficiency, a plan for the improvement of employee relations, a conceptual scheme for the understanding of employee dissatisfaction, social organization of employees, applications to practice of research results.

VIOLATIONS OF FREE SPEECH AND RIGHTS OF LABOR

Report of the Committee on Education and Labor (74th Congress). United States Government Printing Office, Washington, D. C. 335 pages, tables, index. 30c.

Pursuant to Senate Resolution 266 of the 74th Congress, 2d session, this report purposes to describe and analyze the policies of the National Association of Manufacturers relating to "violations of the right of free speech and assembly and interference with the right of labor to organize and bargain collectively." It constitutes Part III of a larger report entitled *Labor Policies of Employers' Associations.* Chapter I deals with the history of the Association; Chapters II to VI treat with its activities from 1933 to 1938; the last chapter sketches its development from 1895, the date of its inception, to the present.

HUMAN-RELATIONS MANUAL FOR EXECUTIVES

Carl Heyel, Manager, Conference Planning Div., American Management Association, McGraw-Hill Book Co., Inc., 330 West 42d St., New York. 253 pages, index. $2.

Written around the theory that an idea that works in one line of endeavor can very often be applied in another, with the right kind of modification, this book purposes to point out through case examples what actual companies have done and are doing in human relations, in selecting, developing, stimulating, safeguarding, and guiding their working forces. In presenting ideas used by various companies and chosen for their general applicability, the author's intent is to stimulate those with supervisory responsibilities to thinking about those under them.

GRAPHIC PRESENTATION

Willard Cope Brinton, Consulting Engineer. Brinton Associates, 599 Eleventh Ave., New York. 512 pages, index, glossary, $5.

Called a "dictionary, grammar, handbook of the graphic chart language," this book contains 620 illustrations, printed in black and four colors, showing various color techniques, chart-cartoons, posters, maps, dioramas. Methods of reproducing and printing, tips on the selection of paper, and binding techniques are included. Abstracts of recommendations for standards relating to graphic charts approved by the American Standards Association is given. The first part of the book explains how to read a chart; the greater part of the second part gives suggestions on how to make a chart.

PATENT FUNDAMENTALS

Adelbert Schapp of Schapp and Cole, Patent Attorneys. The Industrial Press, 148 Lafayette St., New York. 176 pages, index. $2.

An aid to inventors, executives, and

We have the STEEL!
Immediate Shipment Assured
The ability to deliver promptly is, of course, of out standing importance today, but Ryerson offers still more. The buyer who may need angles, sheets, bars, welding rod, and many other items is assured uniform high quality regardless of the size of his order. Under the Ryerson Certified Steel Plan, stocks include only selected products that meet the most demanding specifications. The purchaser can then concentrate orders for practically all his steel requirements, securing uniform high quality and quick service at a saving of time and money.
Ryerson certified alloy steels are an outstanding example of the care used in the selection of our stocks. To assure uniformity, entire heats (100 to 150 tons) of an alloy that meets our narrow range specifications are secured. Bars are analyzed and tested for chemical and physical properties and heat treatment response. Every bar is clearly identified with the heat number. Data sheets and charts showing properties of the steel and results of the tests are prepared and sent with every order, large or small, as a guide to heat treatment. This valuable service is given at no extra cost.
Ten large Ryerson plants carrying more than 10,000 kinds, shapes, and sizes of steel products stand ready to meet both your regular and emergency requirements. If you do not have the current Ryerson Stock List, we shall be glad to send a copy.
Joseph T. Ryerson & Son, Inc. Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston. Philadelphia, Jersey City.
RYERSON CERTIFIED STEELS
RYERSON

*Four Years to Build his Skill...

a Split-Second to lose it

It takes time and money to train a machinist's hand and eyes to work with top speed and accuracy that mean profits for *you.*

And it is sound business to protect this investment with the best eye-protection available. Give every skilled man a pair of American Optical Goggles that will protect his eyes and your profits. This proven protection is *vital*... for eye-accidents seldom cost less than $14.60 ... usually cost about $393... and often run as high as $2,000.

There is an American Optical Branch in every principal industrial center. So call in your nearest AO representative.... ask him to tell you how you can protect the eyes of *all the skilled men on your pay roll* by "buying American."

*Estimated average in manufacturing industries.

American Optical Company

SOUTHBRIDGE, MASSACHUSETTS

Manufacturers, for more than 100 years, of products to aid and protect vision. Factories at Southbridge, Mass. In Canada, Consolidated Optical Co., Ltd. Branch offices in all principal industrial centers.

students coming in contact with patents, patent attorneys, and patent law, this book has been written in non-technical language with practical examples to explain the principles underlying invention, the procedure in obtaining patent protection, the drafting of effective claims, the making of assignments, and the issuing of licenses. The chemist's problem is discussed together with an analysis of decisions relating to chemical patents. The different conditions under which trademarks, copyrights, design patents, prints, and labels become available are explained and illustrated.

GOVERNMENT AND ECONOMIC LIFE VOLUME I

Leverett S. Lyon, Myron W. Watkins, Victor Abramson. The Brookings Institution, Washington, D. C. 519 pages, index. $3.

In interpreting public economic policy in America and in analyzing those governmental activities which have been applied to a large part of American industrial life, the authors have discussed trends and current issues in the light of the social, political, and economic forces influencing and conditioning them. Some of the questions discussed include: Significant issues in present proposals to modify anti-trust laws; current developments in determination of fair competition; today's issues in government relative to concerted labor action; proposed amendments to the patent laws; relation between our monetary mechanism and monetary management by government; extent to which governmental agencies are being used for new objectives and are being judged by new criteria.

WAGE DIFFERENTIALS

C. Canby Balderston. Industrial Research Department, Wharton School of Finance and Commerce, University of Pennsylvania, Philadelphia. Wage Series No. 1. 39 pages, charts, tables. $1.

This monograph presents a study of wage rates in Philadelphia metal plants in order to show the relationships between the wage rates actually paid in a well-organized labor market. Questions considered include the actual differences in the market rates paid in typical companies for occupations with various degrees of skill and difficulty; the extent to which the pay for similar work varies company by company; and the influence of incentive payment upon employee earnings and upon the skill differentials. Data used consist of rates of pay in June, 1938, of 91 metal plants in Philadelphia and vicinity. A detailed analysis of rates of 31 of the firms was made, and as a supplementary guide, the average daywork earnings collected by the National Electric Manufacturers' Association were also used.

MANAGEMENT AND LABOUR

K. G. Fenelon, Director of the Department of Industrial Administration in the College of Technology, Manchester; Lecturer on Industrial Administration, Manchester University. Chemical Publishing Co., Inc., 148 Lafayette St., New York. 276 pages, index. $3.

This survey of present-day industrial organization, with special reference to personnel problems and practice, deals with the development of systematic methods of management, business organization, labor organization, working conditions and factory environment, industrial relations and labor management, absenteeism and labor turnover, arbitration and conciliation in labor disputes, statutory and voluntary welfare, wage systems, state regulation of wages, industrial diseases and their prevention, industrial accidents, and the problem of economic security for employees.

BETTER INDUSTRIAL RELATIONS THROUGH BETTER UNDERSTANDING

Silver Bay Industrial Conference, 347 Madison Ave., New York. 102 pages. 75c.

Summary report of the Silver Bay Industrial Conference, 22d year, Silver Bay on Lake George, New York, presents in reduced form such topics discussed as management's responsibilities; meaning of the N.L.R.A. in the light of court actions; problems of collective bargaining; symposium on what management can do to help the foreman. Sectional conferences included talks on sick benefits, medical care insurance, hospital plans; trends in old age pensions from the Administration's point of view; determining employee attitudes; job evaluation and salary administration; selection of first line supervisory employees.

When you need Casters
ASK COLSON
COLSON makes casters large enough for heavy duty floor trucks in gruelling industrial service—small enough for office chairs.
From the complete Colson line you can select casters to meet your individual requirements. There are types for attaching to practically any kind of portable equipment. And you can be sure that the caster you select will give many years of continuous, trouble-free service, because Colson casters are built to highest quality standards—not to a price.
THE COLSON CORPORATION • ELYRIA, OHIO
COLSON CASTERS

ON THE CALENDAR

DECEMBER

4–8, American Society of Mechanical Engineers, Annual Meeting, Philadelphia. C. E. Davies, Secretary, 29 West 39th St., New York.

4–9, 7th Exposition of Chemical Industries, Biennial Meeting, New York. Charles F. Roth, Manager, Grand Central Palace, New York.

6–8, National Association of Manufacturers, Annual Meeting, New York. Noal Sargent, Secretary, 14 West 49th St., New York.

JANUARY

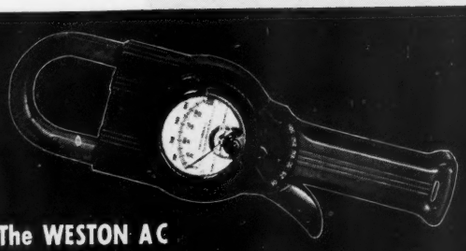
11–13, American Engineering Council, Annual Meeting, Washington, D. C. F. M. Feiker, Secretary, 744 Jackson Pl., N. W., Washington, D. C.

22–26, American Institute of Electrical Engineers, Winter Convention, New York. H. H. Henline, National Secretary, 33 West 39th St., New York.

22–26, American Society of Heating and Ventilating Engineers, Annual Meeting in conjunction with 6th International Heating and Ventilating Exposition, Cleveland. A. V. Hutchinson, Secretary, 51 Madison Ave., New York.

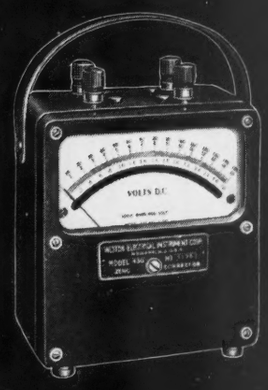
Essential Tools

for efficient plant maintenance



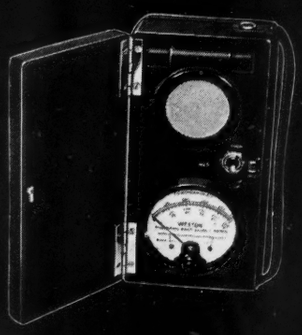
The WESTON AC Clamp-Ammeter

A real time saver. Simply hook the jaws around the conductor while machinery is running, and take the current reading. No production interruptions as circuits are never disturbed. Rugged construction, with high insulation for complete protection. Six current ranges answer all maintenance needs.



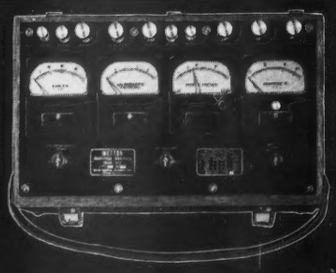
WESTON Model 430 Maintenance Testers

Built to stand active service in the busy shop. Rugged, compact, accurate . . . yet their cost is extremely low. Wide, legible scales make accurate reading quick and certain. Available in AC and DC for all maintenance needs.



WESTON Model 614 Illumination Meter

Essential to keep plant lighting at efficient "seeing" levels. Simply placed on machine or bench working levels, it instantly indicates the amount of light available at that point. Reads directly in foot-candles. Rugged, inexpensive. Available in several models for all needs.



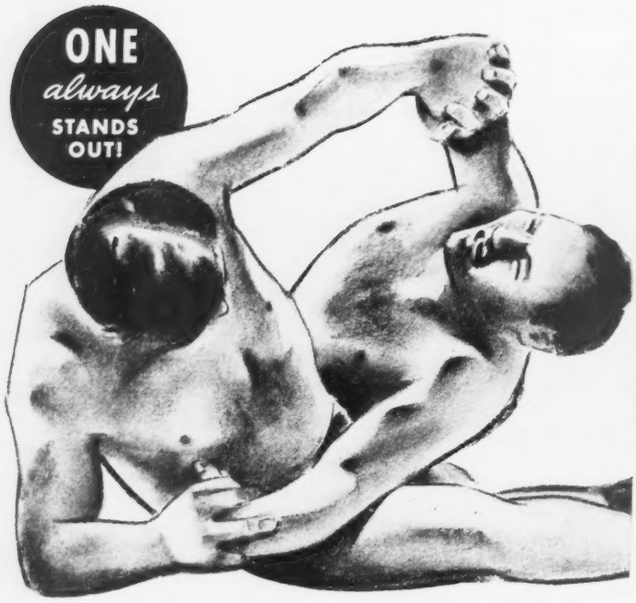
WESTON Industrial Analyzer

Another time saver for the active maintenance department. With all interconnections made, only one hook-up is necessary for complete analyses. Measures current, voltage and power in single and polyphase circuits, as well as power factor in 3 phase, 3 wire circuits. Furnished in sturdy oak carrying case.

WESTON Maintenance Instruments provide *more* than the ruggedness . . . the dependable accuracy . . . for which WESTONS are world famous. They also provide many testing "short cuts"—enabling active maintenance departments to cut "corners and costs" while maintaining all electrified equipment at its highest availability and efficiency. Let us send you complete information on the instruments illustrated above, as well as on others designed *specifically* for maintenance needs. Write to Weston Electrical Instrument Corp., 628 Frelinghuysen Ave., Newark, N. J.

WESTON *Instruments*

ONE *always* STANDS OUT!



Gripping Power...

Like the top-notch wrestler, GARLOCK 725 Rubber Transmission Belting has *exceptional gripping power*, coupled with *strength* and *endurance*. Constructed of high-grade duck, frictioned with Garlock special rubber compound, folded to size and cured under tremendous pressure, this flexible belting *holds fast*, and wears remarkably long. All standard belt sizes from 1-in. x 2-ply to 28-in. x 12-ply. Try it on your toughest job!

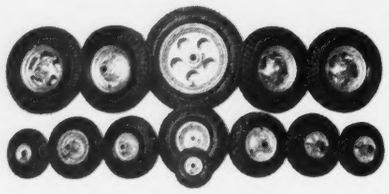
THE GARLOCK PACKING CO.
PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.

GARLOCK 725

Safe • Quiet • Shock-Free • Lasting and Economical

RUBBER TIRED
WHEELS
for INDUSTRY



Thousands of plants are enjoying the advantages of rubber tired wheels. You will be impressed with the quality and permanence of French & Hecht wheels. Full range of sizes, both pneumatic and solid with swivel and rigid forks. Our engineers will gladly assist you to select the correct wheels for the wheeled equipment you use—or make and sell.

SIZES and TYPES for Trucks • Trailers • Carts • Wheelbarrows • Scooters • Riding Toys • Lawn Mowers • Tractors • Farm Machinery • etc., etc.

Write TODAY for 24 Page Catalog

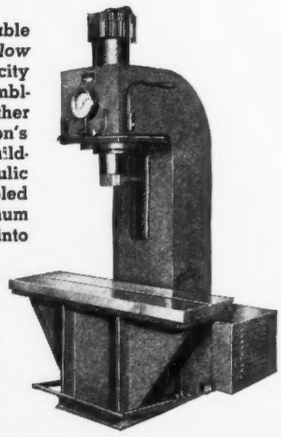
FRENCH & HECHT, INC.
100 Farnam, Davenport, Iowa

WHEEL BUILDERS SINCE 1888

LET DENISON SOLVE YOUR SPECIAL MACHINERY PROBLEMS!

A NEW HYDRAULIC PRESS FOR
ECONOMICAL ACCURACY
ON YOUR BROACHING, STRAIGHTENING ASSEMBLING, OR OTHER PRESS JOBS

A rugged, dependable hydraulic press at *low cost*—for small-capacity straightening, assembling, broaching or other press jobs. Denison's long experience in building special hydraulic presses has enabled them to build maximum operating efficiency into this new standard-type series. 5 to 50-ton working capacities; 26" stroke; 29" maximum vertical opening. It's compact, complete; only power connections and oil for reservoir are required to put press into operation. You'll want details on this money saving press. Write for specification bulletin.



DENISON
Engineering Company
104 WEST CHESTNUT STREET COLUMBUS, OHIO

Give your draftsmen new seeing ease with revolutionary new *Fluorescent Daylight*

It's cool. It's diffused. It's like daylight . . . the light from these new Daylight MAZDA F Lamps. And it makes *practical* new, higher levels of light to bring new eye ease and new accuracy.

That's why the addition of MAZDA F Lamps with CERTIFIED FLEUR-O-LIERS . . . lighting units that use these new lamps effectively . . . is a big help in departments where eye-work and accuracy are required; in drafting, machine shop assembly, or inspection. Great for color discrimination, too.

Try Certified Fleur-O-Liers in one department of your plant. Your lighting company will be glad to work with you to see that they are properly installed to meet your needs best. Write, telling the type of service in which you are interested and we will send a list of Fleur-O-Lier manufacturers who can help you secure better light for better work. The Fleur-O-Lier Manufacturers, 2116 Keith Building, Cleveland, Ohio.

PRELIMINARY SPECIFICATIONS

The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the SPECIFICATIONS FOR LUMINAIRES, FITTINGS, AND EMBODIED AUXILIARIES FOR FLUORESCENT MAZDA LAMPS.

Because these specifications must include luminaires designed for a wide variety of lighting applications, this certification is in no sense an appraisal of their relative merit for any specific application.

ELECTRICAL TESTING LABORATORIES
NEW YORK, N. Y.

A Copy of This Certificate Should E·T·L 1039 Appear upon Each Unit or Package

FLUORESCENT LIGHTING FIXTURES EMPLOYING EXISTING TYPES OF LAMPS ARE NOT RECOMMENDED FOR SCHOOLS, OFFICES AND SIMILAR LOCATIONS UNLESS LAMPS ARE SHIELDED FROM DIRECT VIEW

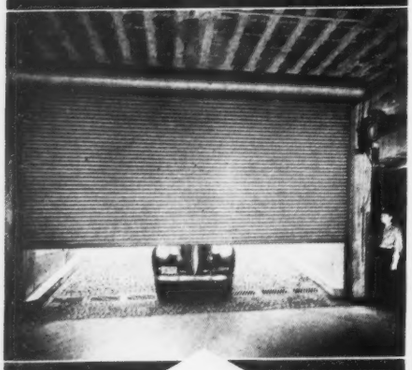
THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 85% POWER FACTOR

LOOK FOR THIS LABEL

when you buy Fluorescent lighting equipment! Then you'll be sure to get equipment that meets over 50 essential electrical and mechanical specifications for satisfactory service . . . duplicates of random selections checked by Electrical Testing Laboratories. This requires the use of E.T.L. Certified auxiliaries for efficient operation.

FLEUR-O-LIER *Manufacturers*

KINNEAR
ROLLING DOORS



EFFICIENT
FROM THE GROUND UP

Coils above lintel — saves space!

Opens out of reach of damage!

Raises over snow, ice, obstacles!

Can't bind, warp, sag or pull apart!

Repels fire; defies intrusion, weather!

Slats can be individually replaced!

Designed to fit the opening — easy to install!

You know you're going to get money-saving door efficiency when you install Kinnear Rolling Doors. They've been tried and proved in the world's best testing grounds — in actual use, under some of industry's most gruelling conditions — for more than forty years! And talk about durability! Rugged steel slats formed into an all-steel curtain and anchored in rigid steel jamb guides, make Kinnear Rolling Doors almost wearproof! They're built for any doorway, for motor or manual control. Let us send you complete details. Write today!

The KINNEAR
MANUFACTURING COMPANY
1540-60 FIELDS AVENUE
COLUMBUS OHIO
Agents in Principal Cities

FOR HARD-TO-CLEAN FLOORS

Here is a heavy duty Finnell designed expressly for the industrial industry . . . for hard-to-clean floors . . . floors embedded with heavy coatings of dirt, oil, grease, or steel shavings. Its two scarifying brushes literally dig out the dirt. Far better and faster than inadequate hand spuds.

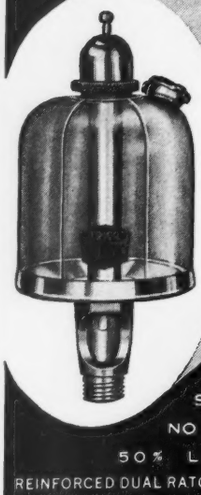
Brush rings are removable—may be replaced with conventional tampico or palmetto brushes and used for scrubbing, steel-wooling, waxing, or polishing floors.

FREE DEMONSTRATION

Phone nearest Finnell branch, or write:

FINNELL SYSTEM, Inc.
2512 East Street • Elkhart, Indiana

New!!
TRICO



UNBREAKABLE
GRAVITY
FEED
OILERS

ULTRA-MODERN
UNBREAKABLE
STREAM-LINED
NO GASKETS TO LEAK
50% LESS WEIGHT
REINFORCED DUAL RATCHET FEED ADJUSTMENT

AMERICA'S FINEST GRAVITY FEED OILER. MODERNIZED AND STREAMLINED TO HARMONIZE WITH ADVANCED IDEAS OF MACHINE DESIGN. 12 DISTINCTIVE FEATURES—METAL PARTS CADMIUM-PLATED FOR BEAUTY AND EASY-CLEANING. 3 STYLES IN ONE, TWO, FOUR AND EIGHT OZ. CAPACITIES.

WRITE FOR BULLETIN No 26

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

For the stranger in our midst—

When a copy of FACTORY is handy in plant or office, a non-subscriber like you is bound to pick it up and glance through it. With benefit certainly, for there's plenty in this and every other number of value to you, if you hold a responsible position in industry.

Chance readers like you are 'strangers in our midst.' FACTORY welcomes you and hopes to be favored with your personal subscription. For your experience is valuable—the more 'strangers' that come into the fold the better for them and the present subscribers.

Because the cooperative nature of FACTORY makes every subscriber a potential contributor—there's a constant pooling of ideas and constructive comment for the benefit of all.

Chance reading of FACTORY, we repeat, is valuable as far as it goes. But just scanning a copy once in a while won't yield the full measure of practical aid that the service holds for you.

The very article that would be of immeasurable help to you might be in an issue you miss. The safe way is a personal subscription. Place it now—then you will be sure to get every single fact, figure and idea that is new and important.

FACTORY—330 West 42nd Street New York, N. Y.

Subscription Rates—United States, Canada, Mexico, and Central and South American Countries, $3 a year. All other countries, $4 a year.

FACTORY'S Catalog Service

Use the Coupon to Secure Valuable Manufacturers' Literature

FACTORY, through the cooperation of leading manufacturers, makes it possible for you to secure catalogs, bulletins, and booklets listed here without cost or obligation. Check and fill out the coupon below and send it to FACTORY.

1 **ALUMINUM ALL-PURPOSE STAGES**—Form 242 contains general information and specifications on standard stages for painters, construction and maintenance crews, etc. Aluminum Ladder Co.

2 **AUTOMATIC LUBRICATION** — Fourteen reasons for automatic lubrication and its aid in maintaining machine efficiency is contained in Bulletin J. Bijur Lubricating Corp.

3 **AXIAL FLOW FANS**—Illustrated catalog on axial-flow ventilating sets, volume and pressure types, includes over 200 fans ranging in size from 8 in. to 10 feet. Tables on size and capacity. De Bothezat Ventilating Equipment Div., American Machine and Metals, Inc.

4 **BALL-BEARING LINESHAFT BOXES**—Entire line is described. Complete details and specifications are given on all types of hanger boxes. Tables on spacing data for mounting hanger boxes with couplings, standard keyseats for shafts, horsepower of shafting and belting, and lubrication suggestions are included. The Fafnir Bearing Co.

5 **BEARING SIZE-FINDER** — Convenient pocket-size slide rule which can be used to find the nearest size standard stock bronze bearing for almost any replacement need. Covers range of more than 800 stock bearing sizes available for immediate shipment. Johnson Bronze Co.

6 **CAR PULLERS, HOISTS, AND WINCHES**—Information, specifications, dimension drawings, and illustrations concerning car pullers (horizontal and vertical capstans), hand-operated and motorized winches, and friction-drum hoists, are contained in new Catalog 1339. Stephens-Adamson Mfg. Co.

7 **CARE AND MAINTENANCE OF PORTABLE ELECTRIC TOOLS**—Pocket-size handbook contains some helpful hints on care and maintenance of tools, methods of grounding to protect operator, currents, proper sizes of extension tables, pointers when tools fail to operate. The Black & Decker Mfg. Co.

8 **CENTRIFUGAL BLOWERS AND EXHAUSTERS**—Bulletin 120-B11, illustrating and describing construction and applications of single- and multi-stage centrifugal blowers and exhausters, contains pressure-volume curves and information on operating characteristics. Roots-Connersville Blower Corp.

9 **CHAINS AND SPROCKETS**—List prices, specifications, illustrations and diagrams of detachable chains; sawmill pintle, special pintle, and closed-end pintle chains; steel refuse chains; bevel-top transfer chains; steel-bushed and steel thimble roller chains; ley-brushed chains; ice chains; combination chains; malleable roller chains; riveted and detachable drag or sawdust chains; car haul chains; vulcan and operating chains; are contained in a comprehensive 139-page catalog, No. 60-A. Webster Mfg. Co., Inc.

10 **CLEANSER**—Facts about and applications of red-label, brown-label, yellow-label, white-label, and black-label Annite are presented in folder form. Quigley Co., Inc.

11 **COMBINATION AIR STRAINER AND LUBRICATOR**—Leaflet describes the air strainer-lubricator that supplies oiled air to tools. Specifications are given. C. A. Norgren Co., Inc.

12 **CONTROLLERS**—For applications where "open and shut" or 2-position control is desired. Technical data on construction and operation are supplemented with schematic illustrations and diagrams. Charts of temperature control, humidity control, liquid level control, and refrigeration control, from typical installations, are reproduced and explained. Installation photographs and data, tables of chart ranges, general specifications and mounting dimensions are included. Bulletin 184-3. The Foxboro Co.

13 **DIAL-TYPE THERMOMETERS** — 24-page illustrated booklet No. 148-5, containing complete explanations and descriptions of line of indicating thermometers, discusses methods of installation; presents typical installations; gives specimen scales for each class of thermometer. The Foxboro Co.

14 **DIRECTED RADIANT ENERGY EQUIPMENT**—Pamphlet gives detailed description, advantages, uses, and prices on infra-red-ray reflectors and lamps for heating, baking, drying. Infra-Red-Ray Devices, Inc.

15 **ELECTRIC HAMMERS** — Handbook on portable electric hammers gives details of operation, typical uses (illustrated), complete list of available hammer tools, pointers on maintenance and operation, and features and specifications. The Van Dorn Electric Tool Co.

16 **ELECTRICAL SAW**—Leaflet on Model 65 Mall Saw contains illustrations, specifications, and uses of the saw. Mall Tool Co.

17 **FACE SHIELDS** — Illustrated pamphlet gives details on the 4-in-1 face shield with interchangeable mesh monel screen, plastacele window, welding shield, acid shield. Details on other models also given. The Boyer-Campbell Co.

18 **FILTERS**—"80 Ways to Make More Money," presenting 80 cases of "continuously cleanable" filters at work in the process, power, and heavy industries, is an interesting, well-illustrated booklet. One section is devoted to the design engineer. Cuno Engineering Corp.

19 **FINISHING METHODS** — Technical review of various methods of applying lacquers and enamels to metal products, and factors to be considered in

MAILING COUPON—GOOD UNTIL MARCH 31, 1940 ONLY.

FACTORY MANAGEMENT & MAINTENANCE (December 1939)
330 West 42nd Street
New York, N. Y.

Please have the manufacturers send me, without obligation, the literature circled below. (Numbers correspond to descriptive paragraph numbers.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58		

Name..... Title.....

Company .....

Street Address .....

City..... State.....

Please fill out this coupon completely in order to avoid delay in handling.

Factory's Catalog Service (Continued)

deciding on methods of application, are discussed in a 5-page pamphlet. Maas & Waldstein Co.

20 **FLOOR MACHINE**—Maintenance of floors with a TriCraft floor worker that sands, polishes, and cleans is explained and illustrated in a new pamphlet. Porter Cable Machine Co.

21 **GRINDERS**—Bulletin gives construction information on pedestal grinders, motor- and belt-driven bench grinders, and buffers that "cannot forget their goggles." Safety shields and dust collectors are described. Specifications are given. The Delta Mfg. Co.

22 **GRINDERS, SANDERS, BUFFERS, MOTORS, ROTORS AND STATORS**—New catalog covering complete line of aerial grinders (high-speed, heavy-duty tool post and pedestal-mounted models), pressure blowers, volume blowers, portable submersible pump, grinders, sanders, high-power rotors and stators, and accessories is illustrated, and contains specifications. Sawyer Electrical Mfg. Co.

23 **HEATER**—Comprehensive catalog describes and illustrates the heating element, propeller fan, motor, and cabinet of the hiJet heater; explains selection and applications of the various models; gives heat loss calculations, electrical and wiring information, piping instructions, trap selection tips; and contains capacity and dimension tables. The Herman Nelson Corp.

24 **"HOW TO SELECT PROTECTIVE DEVICES FOR LOW-VOLTAGE POWER CIRCUITS"**—Bulletin GEA-2634 discusses the problem of interrupting capacity; gives information on selection of various types of air circuit breakers for low-voltage circuits (on arrangement of feeder breakers to assure continuous production; on protection of main feeders) and tells why the circuit breakers protect and how they are installed. Well illustrated. General Electric Co.

25 **HUMIDIFIER**—Diagrams, illustrations, and descriptions explain advantages, construction, and installations of the K-2A and K-4 humidifiers. Operation and capacity tables, and list prices are given. Armstrong Machine Works.

26 **INDIRECT AIR HEATING** — The story behind the heavy-duty indirect air heater, the problems it solves, its construction features and applications, are set forth in a new bulletin, No. 74. Dimensions and ratings are included. Despatch Oven Co.

27 **JET PUMP**—Attractive, 4-page pamphlet presents a "small-purpose" pump, describes its construction and uses, and includes operation and engineering data. Pomona Pump Co.

28 **LATHES**—112-page lathe catalog describes and illustrates 75 different sizes and types of back-geared screw cutting lathes for production manufacturing, toolroom and general shop work. Different models for each size are shown; specifications are given. South Bend Lathe Works.

29 **LINESTARTERS** — Bulletin describes De-ion non-reversing linestarters, for across-the-line starting of squirrel-cage induction motors, includes features, advantages, ratings, and diagrams and illustrations. Descriptive Data 11-200. Westinghouse Electric & Mfg. Co.

30 **MOTOR LUBRICATION** — Description of Lubriflush, "newest development in bearing lubrication," and how it is used, is presented in a 4-page folder. U. S. Electrical Motors, Inc.

31 **MOTORS**—4 bulletins. GEA-1698A contains information on construction features of general-purpose, constant- and adjustable-varying-speed, wound-rotor, induction motors, 1 hp. and larger, Types M and MT. GEA-1807B: Outstanding features of Types KT, FT, FTR squirrel-cage induction motors, 100-1,500 hp. Detailed description, with illustrations, of stators and rotor. GEA-98B: Features and characteristics of Type RB, single-phase, repulsion, brush-shifting motors, ¼ to 3 hp. GEA-1276D: Advantages, applications, characteristics, construction data, modifications, ratings of split-phase motors, Type KH, 1/60 to ⅓ hp. General Electric Co.

32 **MULTI-BREAKER** — Applications, features, construction details, and prices of Type MO multi-breaker—15, 20, and 25 amp.—are given in an illustrated leaflet. Colt's Patent Fire Arms Mfg. Co.

33 **MULTI-RATIO DRIVE**—Technical information; construction diagrams; assembly diagrams and numbers for right and left hand installations; charts on motor and V-belt data, motor and motor-base data; torque-speed ratings; and installation photographs are contained in Catalog D-2 on multi-ratio drive units—horizontal and vertical tyes. Mechanical Handling Systems, Inc.

34 **OILLESS BEARINGS**—History of Metaline oilless bronze bearings, types manufactured and flexibility in meeting unusual requirements, are contained in Catalog 4. Uses of Metaline bearings, plates, and disks are described and listed. Size and specification tables, and instructions for installation are included. R. W. Rhoades Metaline Co., Inc.

35 **PIPE THREADER** — Bulletin describes ratchet pipe threader having 4 sets of dies, separate set for each size, 1-2 in. No. 0 open-side pipe vise stand and work bench is also described. Threader and vise are illustrated. Prices given. The Toledo Pipe Threading Co.

36 **PIVOTED MOTOR DRIVES**—16-page illustrated pamphlet explains basic principles underlying operation of pivoted drives, and presents price and dimensional information on various types and their applications. Rockwood Mfg. Co.

37 **PULLEYS**—Standard stock motor pulleys and made-to-order motor pulleys are described in a new folder that contains list prices, quantity, discounts and total face widths. Facts about flat-belt drives and steel split pulleys and accessories, together with list prices and discounts, face widths, measurements, and illustrations are contained in Catalog P-39. The American Pulley Co.

38 **PUMPS** — Revised bulletin on "SSU"nit Pumps tells "How to Get More Gallons at Less Cost" out of small-size close-coupled pumps. Construction details, performance data, capacity tables, dimension sheets, friction tables, and illustrations are included in Bulletin B-6018. Centrifugal Pump Div., Allis-Chalmers Mfg. Co.

39 **PUMPS** — Catalog 127A fully covers line of pumps including water-lubricated and oil-lubricated turbines, propeller and mine pumps, and the new Hi-Lift pump. Ten different types of turbine pump heads are illustrated with details on both water and oil lubrication of all models. Hydraulic engineering data and installation views provide suggestions as to power hookup and methods of installation. Peerless Pump Div., Food Machinery Corp.

40 **RADIAL SAW**—Two well illustrated folders give features, uses, advantages, and specifications of a new radial saw for dadoing, tenoning, shaping, routing. Walker-Turner Co., Inc.

41 **RED DEVIL TOOLS, MACHINES, AND MISCELLANEOUS ARTICLES**—64-page catalog No. 17 describes, illustrates, and gives specifications for glass cutters and pliers, putty knives, wood scrapers, glaziers' points, electric paint conditioners and fencers, painters' and glaziers' tools, floor sanding machines, axe and hammer wedges. Landon P. Smith, Inc.

42 **SEPARATORS AND MAGNETIC DRUMS**—Bulletin 93-A describes line of automatic spout drum magnetic separators and magnetic drums. Bulletin 97 covers spout-type magnetic separators—enlarged models for large capacity requirements. Complete specifications as to size, weight, etc. Illustrations and diagrams. Stearns Magnetic Mfg. Co.

43 **SPEED CHANGER**—Bulletin tells how Vari-Pitch speed changers help in "Keying Production to Profits." Installation views show how industries are using the units; manual and electrical remote-controlled units are shown; dimension sheets and speed-range tables are included. Allis-Chalmers Mfg. Co.

44 **STEEL STRAPPING**—Booklet describes box strapping, strapping tools, strapping for bales, stitching wire for cartons, barbed box straps for crate corners and recoopering purposes, corrugated wood joint fasteners. Size tables are included. Acme Steel Co.

45 **STORAGE-BATTERY CELL**—D-type cell, said to afford 33⅓ per cent more capacity in approximately the same floor space, is announced in a pamphlet describing it and containing electrical data and weight of cells and dimensions of cell trays. Edison Storage Battery Div., Thomas A. Edison, Inc.

46 **STRIP-CHART RECORDER**—Bulletin GEA-3187A gives important features, construction details, diagram of marking mechanism, illustrations of typical records, and detailed data on light-weight, portable, inkless, strip-chart recorder, Type CF-1, for indoor or outdoor survey work. General Electric Co.

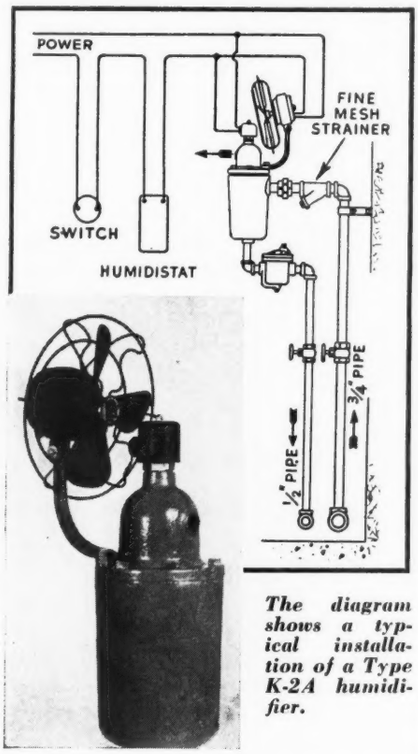
47 **SUSPENDED MAGNETS**—Bulletin, 25-A, on line of suspended magnets—high-duty circular-type separator magnets, rectangular separation magnets, and rectangular suspended magnets—describes and illustrates each type and gives specifications. Stearns Magnetic Mfg. Co.

48 **SWITCHES**—Catalog 9 contains illustrations and diagrams of switches, switch connections and switch developments, and specifications on instrument and control switches. Roller-Smith Co.

49 **SYNCHRONOUS MOTORS**—Well-illustrated 62-page brochure on synchronous motors contains a general description of the motors; points out their economies; includes a ratings chart on the

Now! An Easy Way to End "DRY AIR" Complaints

IF YOU have complaints during the winter heating season about drying out of materials . . . shrinkage and warping of boards . . . curling of flat material . . . brittleness of thread or filaments . . . trouble with static-charged machines, then it would be a good idea for you to know about Armstrong Steam Type Humidifiers.



The diagram shows a typical installation of a Type K-2A humidifier.

TYPE K-2A shown here is a unit humidifier for overhead mounting in rooms heated by individual pipe coils or radiators. It is also ideal for mounting in front of individual unit heaters. Long rooms are taken care of by spacing these units at proper intervals. LIST PRICE: $100.00 complete with Friez Humidistat, solenoid control valve, fan, strainer, and condensate drainage trap. Discounts on application. Interesting descriptive bulletin will be mailed to you on request. ARMSTRONG MACHINE WORKS, 804 Maple St., Three Rivers, Mich.

ARMSTRONG
STEAM TYPE
HUMIDIFIERS

various motors; discusses the general construction and operating characteristics of high-speed and low-speed synchronous motors; describes special types, motor-generators, and power factor; and illustrates applications in various industries. GEA-1191B. General Electric Co.

50 **THE NEW PLANT**—Graphic comparison and discussion of relative building and operating costs in single-story and multi-story plants, and a discussion of relative advantages and disadvantages as to cost of air conditioning, heating, ventilating, etc., is presented in pamphlet form. The Austin Co.

51 **THERMOMETERS AND PRESSURE GAGES**—Colorful booklet describes new line of vapor-actuated, gas-actuated, and mercury-actuated thermometers. Indicating, and 1-, 2-, and 3-pen recording models are illustrated. The Brown Instrument Co.

52 **TRUCKS**—60-page catalog fully describes, illustrates, and gives specifications for line of electric industrial trucks, hand-lift trucks, and skid platforms. The Yale & Towne Mfg. Co.

53 **TURBINE PUMPS**—Bronze-fitted, all-iron, and all-bronze turbine pumps are described in a bulletin that details the design features; includes installation views, a cutaway view of the pump, a diagram of the internal seals, a typical performance curve, and standard specifications. Selection tables and price lists are carried in a supplemental folder. Roots-Connersville Blower Corp.

54 **VALVES**—Different kinds of pressure-sealed Nopak valves—air-operated, foot-operated, solenoid-operated, hydraulic-operated types—are described in a 19-page illustrated bulletin No. 65. Installations, cycles of operation, features and advantages, uses, dimensions, prices, are included. Galland-Henning Mfg. Co.

55 **VALVES AND FITTINGS**—New catalog, No. 78, illustrates, describes, and lists complete line of bronze, iron, and steel valves; boiler mountings; lubricating devices; oil and grease cups, whistles, cocks. Prices and dimensions are given. Figures on thermodynamic properties of steam saturation as to pressures, and thermodynamic properties of steam superheated vapor, are included. 136 pages. The Lunkenheimer Co.

56 **WELDING IDEAS FOR LOW-COST MAINTENANCE** — Bulletin presents 101 ideas on money-saving repair, fabrication and structural applications of arc welding, method of repair and fabrication by the electric-arc process. Illustrations and descriptions giving procedure data; sizes of materials; savings in weight, time, and cost; are included. The Lincoln Electric Co.

57 **WIRE ROPE**—Pocket-size handbook contains practical and technical information, list prices, and specifications of the various constructions of wire rope. Hazard Wire Rope Div., American Chain & Cable Co., Inc.

58 **WIRE ROPE CLAMP**—Construction, advantages, and sizes of the Safe-Line wire-rope clamp are contained in a new folder. National Production Co.

59 **WIRE-TYING AND WIRE BUNDLING MACHINE** — Semi-automatic wire-tying machine for shipping rooms, and wire bundler for mailing rooms are described and applications are illustrated. The Gerrard Co., Inc.

Check Numbers On Coupon P. 135

You are paying for

PLANNED WASHROOMS

Why not have them?

POORLY ARRANGED and equipped washrooms cause loitering and delay—eat up overhead. You pay your people for such time wasted, as well as for the time they work.

The Scott Washroom Advisory Service can help you plan washrooms to cut costs in terms of time saved and increased good will. It will indicate how washrooms can be made a constructive feature of *practical* industrial relations.

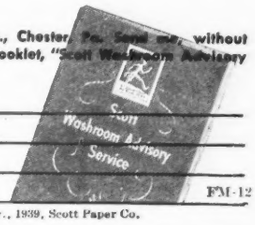
• • •

FREE! "Scott Washroom Advisory Service" Booklet. We suggest you send for this interesting booklet of efficiency and cost-reducing facts already used to put thousands of plant and office washrooms on a more satisfactory, economical basis.

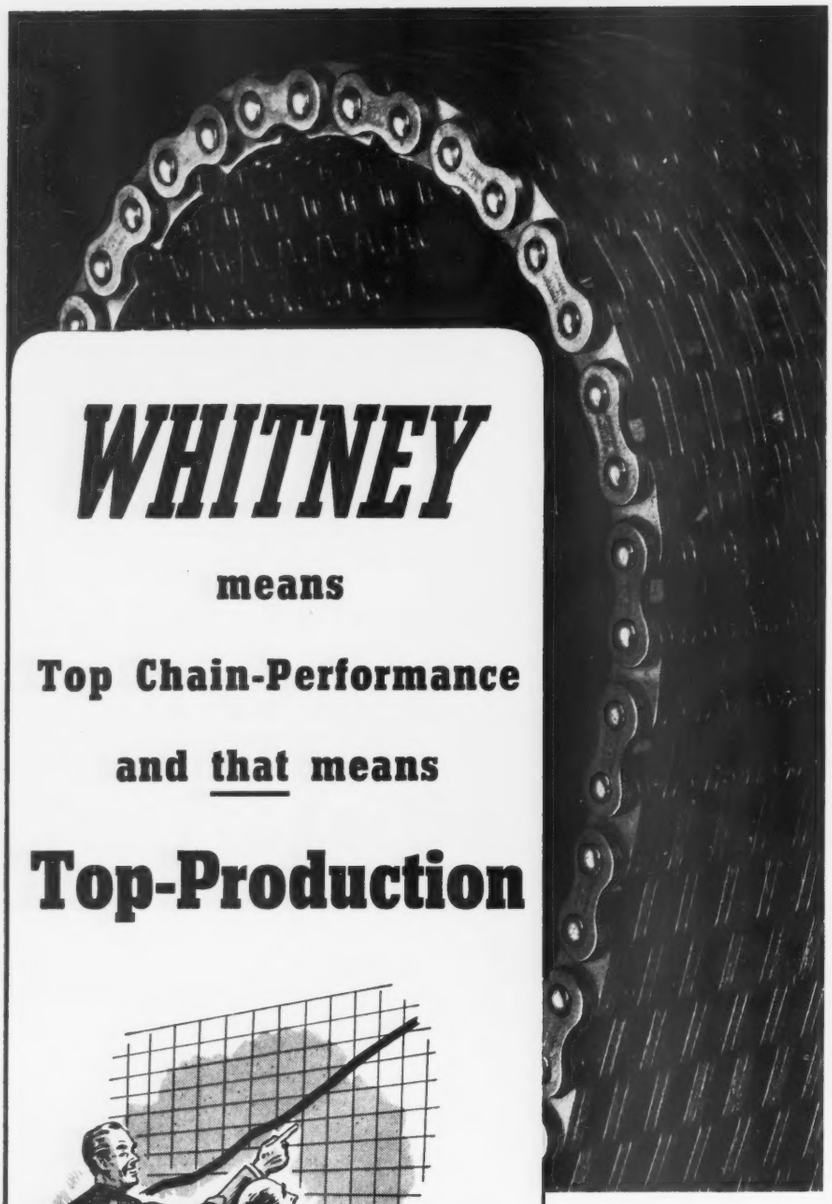
How to relieve congestion . . . how to cut hidden washroom overhead . . . how planned washrooms actually create good will—these are some of the problems of washroom management considered in this booklet.

• Scott Paper Co., Chester, Pa. Send me, without obligation, your booklet, "Scott Washroom Advisory Service."

Name_____
Position_____
Firm_____
Address_____ FM-12



Copr., 1939, Scott Paper Co.



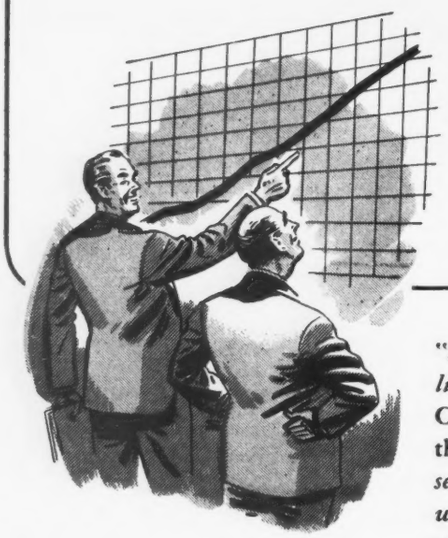
WHITNEY

means

Top Chain-Performance

and that means

Top-Production



"Silence is golden" . . . and that's *literally* true of Whitney Silent Chains. For their silence extends all the way to maintenance . . . *you seldom hear from them, once they're at work.* They simply tend to their job of delivering highest transmission efficiency, full machine output, consistent product-uniformity. More, they stand up to shock loads without complaint, and lead extra-long useful lives. These and other money-saving characteristics are fully explained and illustrated in a *new 64-page book* on Whitney Silent Chains. Send today for *your* copy of Brochure V-135.

THE WHITNEY CHAIN & MANUFACTURING CO.

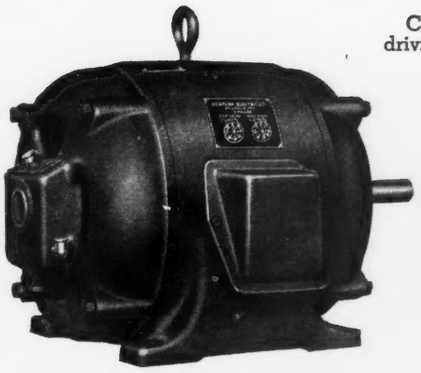
Hartford, Connecticut

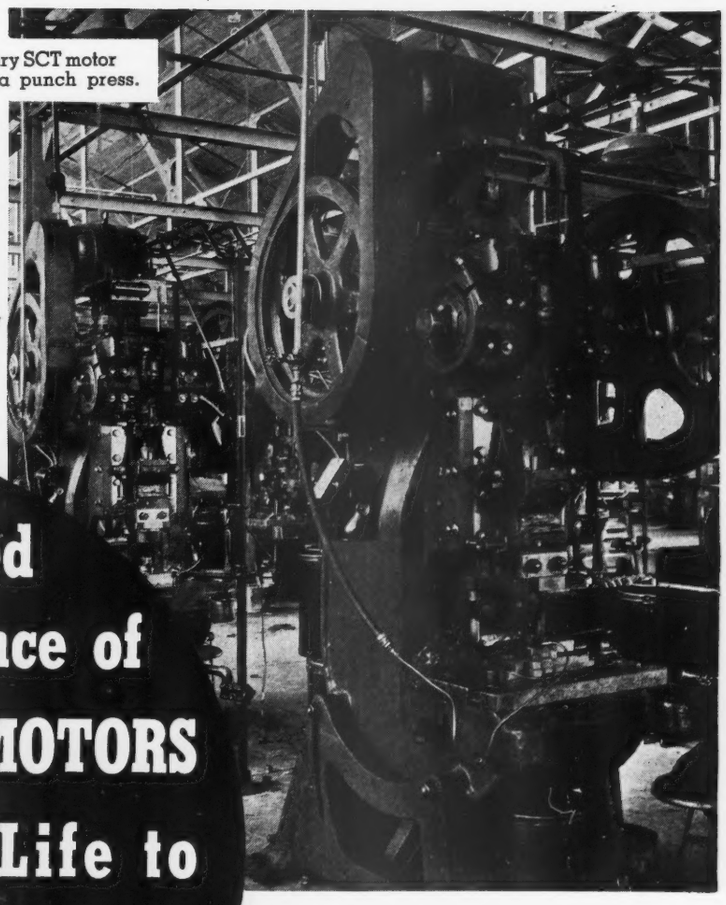
Perpetual Equipment Show

Do you realize that leading equipment and materials manufacturers conduct a perpetual equipment show for you every month in the advertising pages of FACTORY?

In these pages they bring to you their latest available information and ideas. During the course of a year, you find in FACTORY around 1500 pages of advertising from 300 leading manufacturers.

As one reader put it—"I consider the advertising pages of FACTORY a most useful source of information on the latest developments in equipment and materials."





Century SCT motor driving a punch press.

The Specified Motor Performance of Century SCT MOTORS Assures Longer Life to Punch Press Equipment

● The important advantages of Century's ***Specified Motor Performance*** means you can predetermine how certain features of motor design can be stressed to give better individual machine results.

For example the shock impulse of large punch press operations can be cushioned by absorption through certain motor characteristics. This assures smoother power flow—longer life to equipment—least voltage disturbance.

HOW IT WORKS

The Century Type SCT motor has high torque, high slip in speed characteristic. When the motor meets a shock in the machine load cycle, the speed slows down enough to make use of the power stored in the flywheel of the machine — a very important and useful absorber effect, and a smoother current demand.

It will pay you to learn more about the application of Century Motors to your machine tool equipment and the many advantanges of Century's Specified Motor Performance. Call in your nearest Century Motor Specialist for complete information. He's always at your service.

CENTURY

Specified Motor Performance

Means a high degree of technique in making and applying electric motors to produce predetermined machine results — whatever the machine application may be.

The trade has come to accept the Century organization as motor specialists because for 36 years Century has devoted its time and ability to this one task.

Specialization plus a wide range of motors makes it possible to assure ***Specified Motor Performance.*** You get this extra service at no extra cost.

CENTURY ELECTRIC COMPANY

1806 Pine Street St. Louis, Mo.

Offices and Stock Points in Principal Cities

Century MOTORS

One of the Largest Exclusive Motor Manufacturers in the World

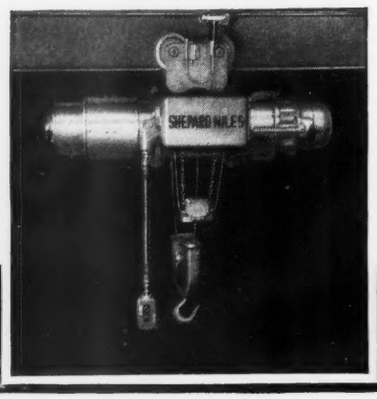
PUSH BUTTON CONTROL

MULTIPLE OR SINGLE SPEED FOR ELECTRIC CRANES AND HOISTS!

● Shepard Niles multiple speed push button control provides 5 selective speeds by one push button for each travel motion. Each button as it is pressed inward makes five electrical contacts, corresponding to five independent speeds in each direction of travel.

Push button master switch cases are of aluminum alloy and made slender enough to be grasped easily with the hand. An assembly of two or three master switches in tandem can be furnished for the control of 2-motor and 3-motor cranes and hoists. An emergency stop switch is provided at the lower end of the assembly.

Shepard Niles multiple speed push button control for all 6 travel motions applied to 3-motor electric traveling crane.



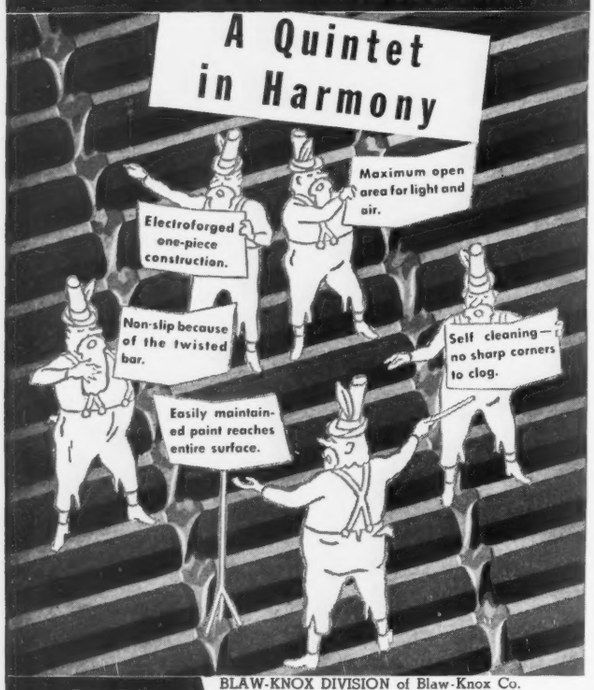
Shepard Niles LiftAbout equipped with single speed push button control.

A COMPLETE LINE OF CRANES & HOISTS

SHEPARD NILES CRANE & HOIST CORP.

364 SCHUYLER AVENUE... MONTOUR FALLS, N. Y.

BLAW-KNOX *Electroforged* STEEL GRATING


A Quintet in Harmony
Maximum open area for light and air.
Electroforged one-piece construction.
Non-slip because of the twisted bar.
Self cleaning — no sharp corners to clog.
Easily maintained paint reaches entire surface.

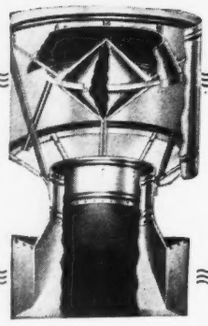
FREE

Paper weight size sample... Just fill in and mail the coupon.

BLAW-KNOX DIVISION of Blaw-Knox Co.
Farmers Bank Bldg, Pittsburgh, Pa.
SEND GRATING SAMPLE TO

Name_____
Street_____
City_____ State_____

BURT VENTILATORS



Free-Flow
GRAVITY VENTILATOR

Improve working conditions, increase production, stop waste by improving ventilation with Burt Ventilators. They give highest efficiency at low cost . . . a specialized type for every purpose. Made in all sizes, all metals. Burt Engineers are glad to help estimate and lay out plans. Write for catalogs.

The BURT MFG. CO.

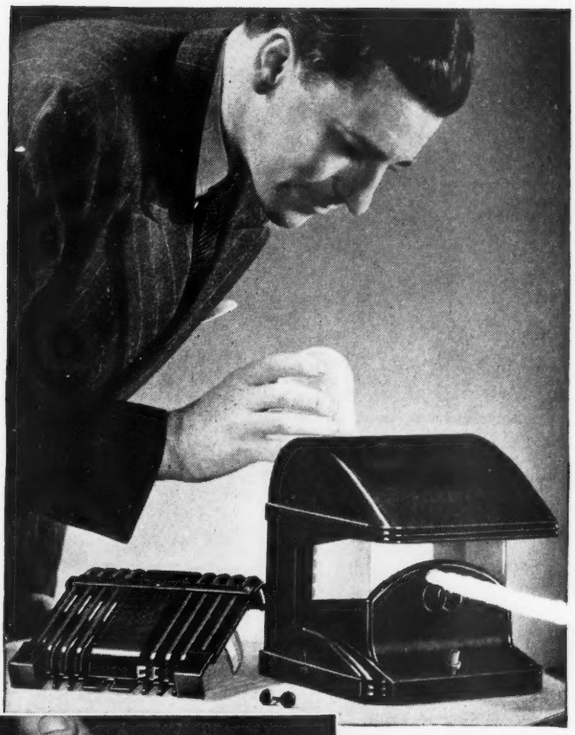
Roof Ventilators Oil Filters Exhaust Heads

955 SOUTH HIGH ST., AKRON, OHIO

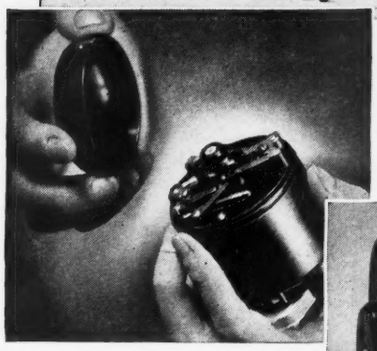
MAKE YOUR PRODUCTS

Tough . . Accurate . . and Easier-to-produce

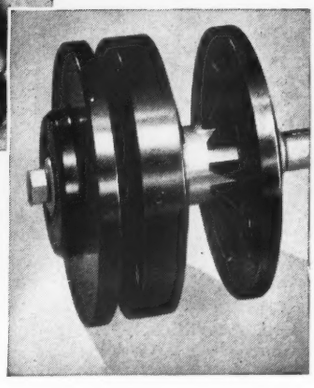
WITH VERSATILE BAKELITE PLASTICS



Polaroid desk lamp housing completely formed in two pieces from lustrous brown Bakelite Molded. Note back panel, removed, with ventilating louvres formed in the single molding operation. Molder: Northern Industrial Chemical Company.



(Above) Durable housing for General Railway Signal Co. constant-speed motor made from black Bakelite Molded. A bronze bearing is permanently and accurately embedded during the molding operation.



(Right) Speedmaster pulley with solid sheaves made from impact-resistant Bakelite Molded. Light in weight, rugged, accurately formed for high speed operation. Molded for Continental Machine Specialties, Inc., by Reynolds Molded Plastics.

HERE are typical examples of just three of the many advantages you may gain by using Bakelite plastic materials.

Toughness for the rugged new Speedmaster variable-speed pulley is obtained by producing each sheave in one piece from special impact-resistant Bakelite Molded.

Accuracy of dimension is a major advantage gained by General Railway Signal Co. in using Bakelite Molded for the two-piece housing of a precision constant-speed motor. Each piece is formed to close tolerances in the mold, assuring interchangeability of parts, and requiring no machining for accurate fit.

Simplified production and assembly were essential requirements of the unique new Polaroid desk lamp. With Bakelite Molded, the intricate housing is completely formed in two pieces, and quickly assembled with two thumb screws.

Other benefits you may obtain from Bakelite plastics include: wide color range; transparent or translucent effects; special chemical or heat resistance; and inherent electrical insulation.

Save time, insure selection of the *right* plastics for your production by consulting Bakelite Plastics Headquarters. Write for Portfolio 16 describing many useful Bakelite materials.

BAKELITE CORPORATION, 247 Park Ave., New York
Chicago: 43 East Ohio Street
BAKELITE CORPORATION OF CANADA, LTD., 163 Dufferin Street, Toronto. *West Coast:* Electrical Specialty Co., Inc., San Francisco, Los Angeles, Seattle.

BAKELITE

The registered trade marks shown above distinguish materials manufactured by Bakelite Corporation. Under the symbol "B" is the commercial sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products.

PLASTICS HEADQUARTERS

How much would it mean to you in the next 12 months

if you could increase the operating efficiency of your department, of your shop, by even a small percentage?

Operation analysis, in almost every case where it is applied, brings to light improvements in operating methods that mean cost reduction, greater efficiency, increased ease of performance. Almost any foreman or supervisor can apply the procedures for operation analysis given in this book, to his department, to his shop, and secure higher operating efficiency.

Just Out!

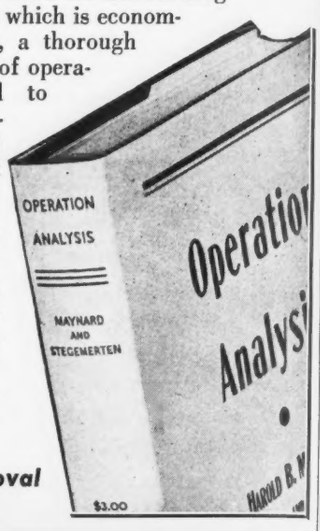
OPERATION ANALYSIS

By HAROLD B. MAYNARD
President, Methods Engineering Council
and **G. J. STEGEMERTEN**
Westinghouse Electric & Manufacturing Co.

296 pages 6x9 $3.00

Here is a book that explains simply, in non-technical language, what an operation analysis is, how any foreman or supervisor can make an analysis, how great improvements in efficiency are being secured in hundreds of industrial plants by careful operation analysis.

Outstanding among the many features of the book is a discussion of the universal applicability of the operation analysis procedure, a method for determining the amount of analysis work which is economically justified on any job, a thorough exposition of the nine steps of operation analysis which lead to methods improvement, process chart construction and common-sense plant layout procedure.



The book is illustrated throughout with case material from the authors' rich experience which show the results accomplished in many fields of industrial enterprise by the application of the various steps of the operation analysis procedure.

See it 10 days on approval
Send this coupon

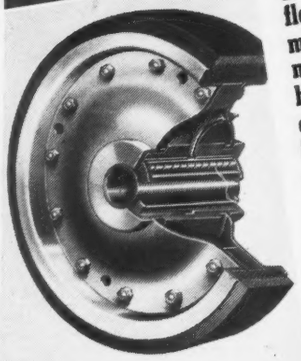
McGRAW-HILL ON-APPROVAL COUPON

McGraw-Hill Book Co., Inc., 330 W. 42d St., N. Y. C.
Send me Maynard and Stegemerten—Operation Analysis for 10 days' examination on approval. In 10 days I will send $3.00, plus few cents postage, or return book postpaid. (We pay postage on orders accompanied by remittances.)

Name .....
Address .....
City and State .....
Position .....
Company .....Fac. 12-39
(Books sent on approval in U. S. and Canada only.)

DARNELL CASTERS and E-Z ROLL WHEELS

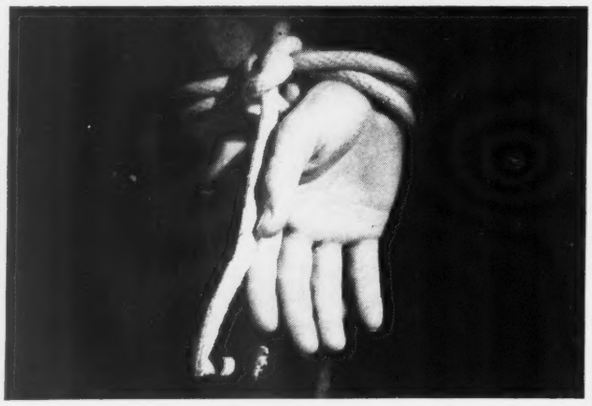
REDUCE THE OVERHEAD THAT IS UNDERFOOT!



If you want maximum floor protection, economy and efficiency Demand Darnell Dependability...Made to give an extra long life of satisfactory service .....

Write for Free 192 Page Darnell Manual describing nearly 4000 types of Casters and Wheels for every industrial use .....

DARNELL CORPORATION, LTD.
LONG BEACH, CALIFORNIA
36 N. CLINTON, CHICAGO, ILL.
24 E. 22ND ST., NEW YORK, N. Y.



CHAPPED HANDS COST MONEY

Why tie your employees' hands by subjecting them to soreness, rawness and irritation caused by chapping?

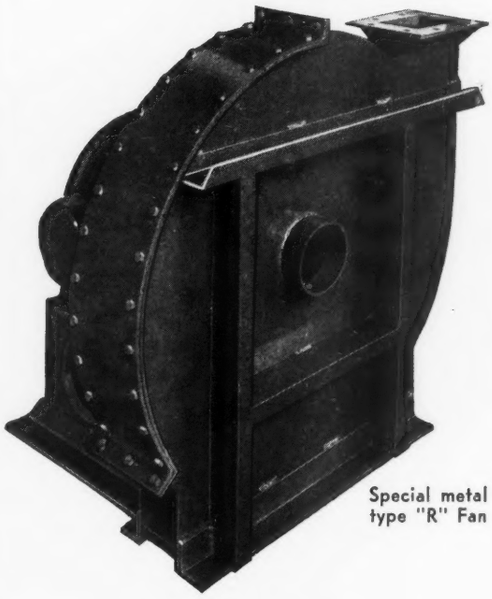
Formula SBS-II Skin Cleanser replaces soap, helps prevent chapping, keeps employees' hands clean, soft and smooth. It removes dirt, grease, grime and bacteria quickly and safely. 2990 plants supply it to their employees. Write Today for generous **FREE TRIAL SUPPLY** to Sugar Beet Products Co., 300 Waller St., Saginaw, Mich.

FORMULA SBS-II
THE INDUSTRIAL SKIN CLEANSER
★ *Replaces Soap*

Check Corrosion! with "Buffalo" Special Fans

Many a plant manager has made a real saving by installing a Buffalo Fan — built specially to combat the particular problem with which he was faced.

With sixty-one years' experience in the fan business, Buffalo engineers are competent to recommend the type of fan and kind of metal which will give you best results. And remember, for all those highly corrosive fumes where RUBBER is the logical choice — Buffalo has fans lined by the B. F. Goodrich Vulcalock Process.



Special metal type "R" Fan

WRITE FOR DETAILS

Why not write us today? Tell us what fumes you are handling, quantity of air per minute. We'll recommend the right equipment and give you prices. No obligation.

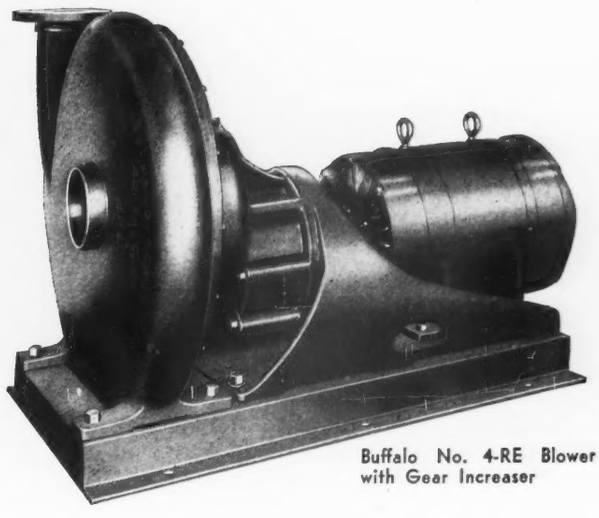
BUFFALO FORGE COMPANY

471 Broadway, Buffalo, N. Y.

Branch Engineering Offices in Principal Cities

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

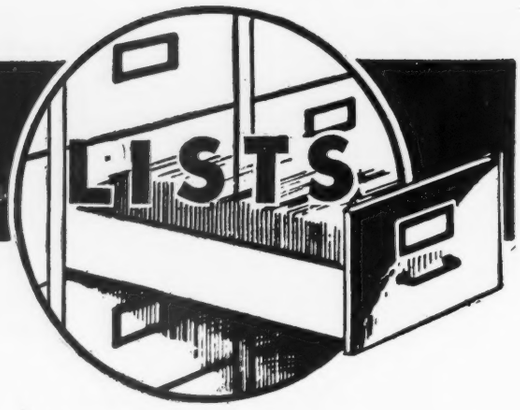
Buffalo No. 5-E Exhauster showing Flanged Inlet and Outlet



Buffalo No. 4-RE Blower with Gear Increaser

McGRAW-HILL

DIRECT MAIL LISTS



A STRONG direct mail campaign, addressed to a selected list of your best prospects and customers is an excellent way to insure maximum results from your sales promotion dollars.

Advertisers who use space in business papers find it advantageous to follow-up their publication advertising with well-timed broadsides, bulletins, sales letters and other mailing pieces. Those companies who cannot afford complete coverage of the field find they can do an effective sales job by mailing to a hand-picked group of worthwhile concerns.

As business paper publishers for over fifty years, McGraw-Hill is uniquely equipped to offer complete, authoritative direct mail coverage of Industry's major markets. 98% accuracy is maintained and, through careful analysis of markets, complete classification of companies, personnel, etc., the widest possible selections are available. Why not send for our handy reference folder "Hundreds of Thousands of Reasons Why"? It describes how McGraw-Hill Lists are built and maintained, and it may help you in your business.

What Fields Do You Want To Reach

Aviation ● Bus & Electric Railways ● Civil Engineering and Construction ● Coal Mining ● Electrical Construction ● Electrical Industry ● Food Industries ● Metal Mining ● Metal Working Industries ● Process Industries ● Textile Industries ● Administrative Executives ● Electrical Dealers & Wholesalers ● Mill Supply Houses ● Power Services ● Product Engineering & Design ● Production and Maintenance ● Radio Dealers & Wholesalers ● Radio Engineering & Design

For further details, selections from above basic classifications, counts, prices, etc., or estimates on special lists . . . ask any representative or write to

DIRECT MAIL DIVISION....
McGRAW-HILL PUBLISHING CO.
330 W. 42nd STREET NEW YORK, N. Y.

. . . Complete lists covering industry's major markets.

Savings?-- LOOK AT THESE!

FUEL COSTS *reduced 60%*
MAINTENANCE *reduced 25%*
OUTPUT *increased 40%*

The economy of Industrial Brownhoist Diesel cranes is not confined to a few exceptional cases. Wherever used — on bucket, hook or magnet work — these cranes are saving thousands of dollars each year over former handling methods. The above percentage figures are an example and are taken from the records of a large steel producer.

Surprising though such figures may sound, they are an indication of the savings you can expect from these modern machines. With capacities ranging from 10 to 50 tons, there is an Industrial Brownhoist Diesel crane of the right size to do a real profit-earning job on your work. Would you like to have our sales engineers help you compile comparative data?

INDUSTRIAL BROWNHOIST

GENERAL OFFICES: BAY CITY, MICHIGAN
DISTRICT OFFICES
New York, Philadelphia, Pittsburgh, Cleveland, Chicago,

MAGNOLIA METALS

MAGNOLIA ANTI-FRICTION METAL

300% Better than Genuine Babbitt . . . . at ½ Cost!

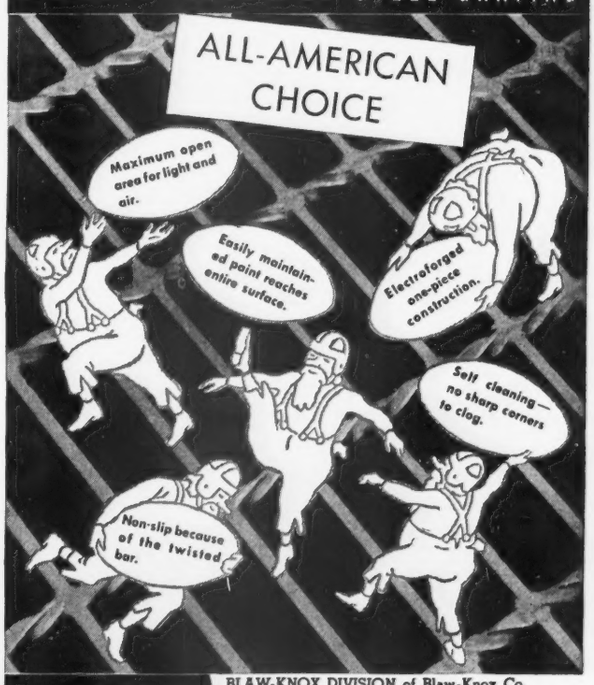
Magnolia Anti-Friction Metal has the lowest coefficient of any known bearing metal. Unequalled for steady high speed and heavy pressures.

For Corliss Engines, Gas Engines, Compressors, Motors above 10 H.P. and all transmissions. Keeps shafts in good condition—lowers your operating costs.

Full details and literature upon request.

MAGNOLIA METAL COMPANY
120 BAYWAY, ELIZABETH, N. J.
SAN FRANCISCO FORT WORTH MONTREAL

BLAW-KNOX *Electroforged* STEEL GRATING

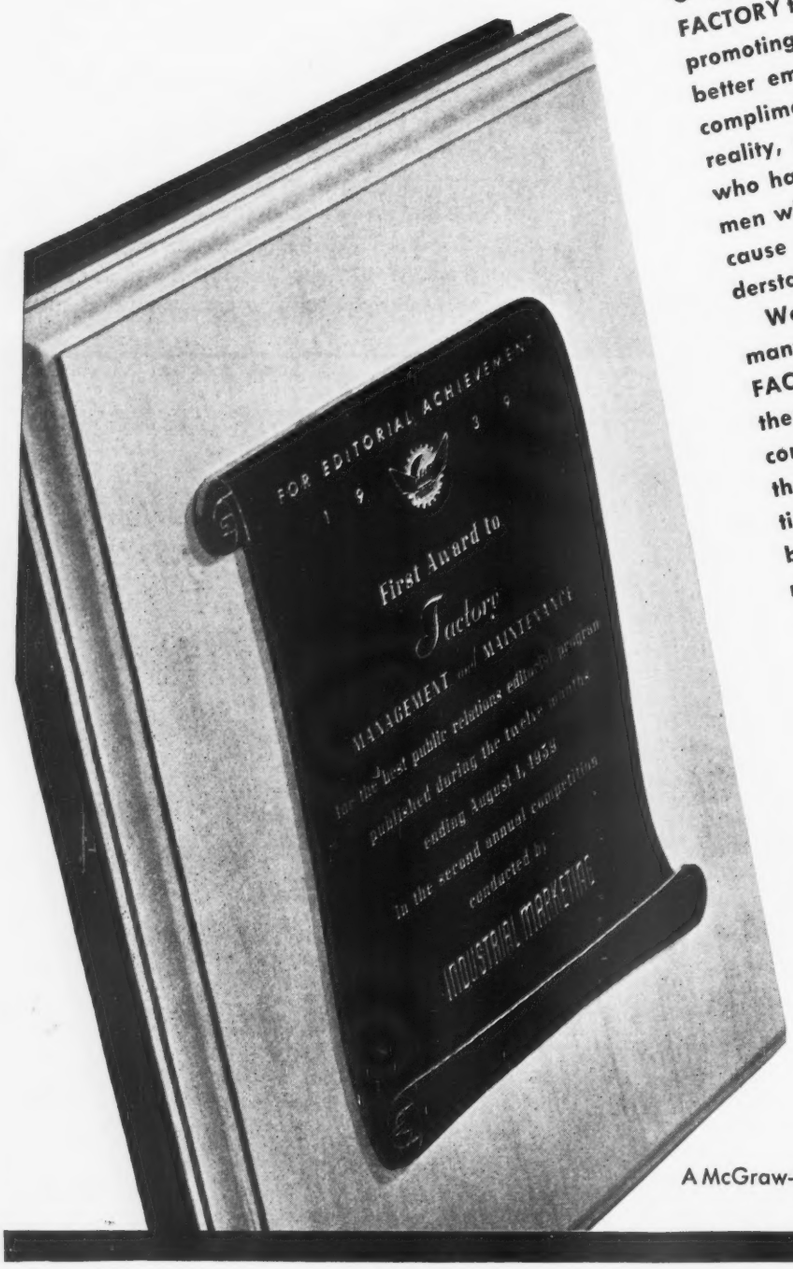

ALL-AMERICAN CHOICE
Maximum open area for light and air.
Easily maintained paint reaches entire surface.
Electroforged one-piece construction.
Self cleaning—no sharp corners to clog.
Non-slip because of the twisted bar.

FREE
Paper weight size sample . . . Just fill in and mail the coupon.

BLAW-KNOX DIVISION of Blaw-Knox Co.
Farmers Bank Bldg., Pittsburgh, Pa.
SEND GRATING SAMPLE TO
Name_____
Street_____
City_____ State_____

FACTORY "CLICKS" AGAIN—

Wins First Award for the Best Editorial Program Promoting Better Employee Relations

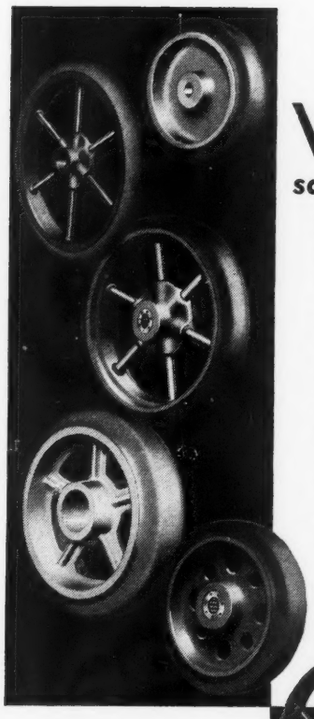


● The *Industrial Marketing* Award to FACTORY for the best campaign of the year promoting better public relations through better employee relations is more than a compliment to FACTORY's editors. It is, in reality, a tribute to the men in industry who have been a part of this program . . . men whose significant contributions to the cause of industrial peace and mutual understanding were reported in FACTORY.

We extend our congratulations to these many men in industry who have helped FACTORY win this Award and share with them the recognition it implies. We also commend *Industrial Marketing* because these Awards serve to focus added attention on what we have long considered to be industry's biggest job—better public relations through better employee relations.

FACTORY
MANAGEMENT and MAINTENANCE

A McGraw-Hill Publication • 330 W. 42 St., New York, N.Y.



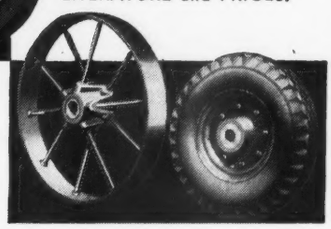
EWC WHEELS

save Trucks, Floors

EWC Rubber Tired Wheels on your trucks or tractors will double their life [illegible] reduce floor maintenance and repair costs . . . speed up materials handling with complete safety . . . insure more truck-miles per man-day or tractor-day . . . save power. And more . . . noise is completely abolished.

There's an EWC wheel for almost every application. They're made to fit old axles, or furnished with new axles and roller bearings.

Whether you're interested in modernizing a single truck or trailer, or an entire fleet, it will pay you to WRITE FOR LITERATURE and PRICES.

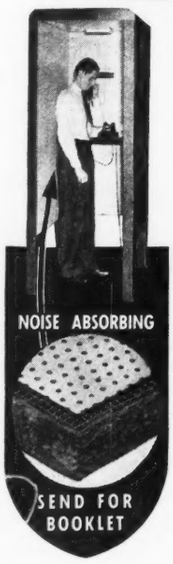


ELECTRIC WHEEL COMPANY

DEPT. FA

QUINCY, ILLINOIS

LOUDER —TALK LOUDER!



This acoustical booth betters phone service

● Shop telephone mistakes are often serious. Improve your shop telephone service and stop these wasteful errors. Do what hundreds of plant managers have done—install a Burgess Acousti-Booth.

Complete Information Sent

Learn why this acoustically engineered booth improves telephone hearing conditions. Find out why it blots up noise and makes telephoning easy. Send the coupon for the Free Booklet giving illustrations of all models, prices, specifications, list of users. SEND IT NOW!

Send this coupon for Free Acousti-Booth Booklet

Name _____

Firm _____

Street, City _____

Burgess Battery Company, Dept. F, 500 W. Huron St., Chicago

Manufacturing under Burgess Patents

BURGESS

are YOU

ON THE DUST HOG'S "MENU"?

UNLESS you have a complete dust control system now operating in your plant YOU ARE! *Make no mistake about it*—this DUST HOG selects his gorging from large and small shops alike—always destroying—always soiling both property and products. HE is the ONE OUTSTANDING NUISANCE that costs YOU and YOU and YOU hundreds of thousands of dollars every year.

What a needless loss!

But wait—there's positive help available for the asking. COME TO PANGBORN! This is the BEST and QUICKEST way to find out. No obligation either. Just write TODAY. See how EASY it is to get O-F-F the DUST HOG'S Menu!

PANGBORN

THE WORLD'S LARGEST MANUFACTURER OF DUST CONTROL AND BLAST CLEANING EQUIPMENT

PANGBORN CORPORATION · HAGERSTOWN, MD.

Cut Production Costs *with*

Carey HEAT-INSULATIONS

Careycel Insulation
For temperatures up to 300°F.

85% Magnesia
For High and Medium Pressure.

Modern industrial plants are saving thousands of fuel dollars each year through the correct application of CAREY Heat Insulations . . . a complete line of high efficiency insulating materials of Asbestos and Magnesia for every known service condition — for temperatures ranging from

SUB-ZERO to 2500° F.

Put your special problems up to Carey Engineers . . . their experience and Carey research facilities are available through branch offices covering the nation. Write for book of interesting, technical data.

Combination Hi-Temp—85% Magnesia.

Hi-Temp Blocks
For Furnaces, Ovens, Kilns, etc.

Hair Felt Insulation
For sub-zero temperatures.

THE PHILIP CAREY COMPANY · Lockland, Cincinnati, Ohio
Dependable Products Since 1873
BRANCHES IN PRINCIPAL CITIES

PLANNING Any Kind of Fan or Blower Installation?

Valuable Information in this 36-Page Book

All types of air handling and air conditioning equipment are described in this catalog—backed by 25 years of experience, sound engineering and continual product advancement. Write Dept. B for your FREE copy.

VORTEX CONTROL
Read about this patented device for regulating air volume — installed in fan or blower inlet. Far more efficient than damper control; far less expensive than variable speed control. Available ONLY on Clarage products. Fully covered in Catalog.

COMPLETE AIR CONDITIONING
COOLING
VENTILATION
FACTORY HEATING
MECHANICAL DRAFT
FANS and BLOWERS for INDUSTRIAL NEEDS

CLARAGE FAN COMPANY—KALAMAZOO, MICH.
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

INDUSTRIAL CONSULTANTS

OLIVER FIELD ALLEN
Licensed Professional Engineer, New York State
Fellow: A.I.E.E. Member: A.S.M.E. S.A.E. Am. Chem. Soc., Soc. Am. Mil. Engrs
Consulting Engineer
Diesel Engines, International Engineering Liaison, Gas and Oil Engine Power Applications.
Regular Foreign Correspondents
117 Liberty Street, New York City
Cable Address: OFALL-New York

A. VANDERFORD EDWARDS
Special Automatic Machinery Research and Designs
Room 1911 149 Broadway
NEW YORK CITY

METHODS ENGINEERING COUNCIL
MOTION AND TIME STUDY INDUSTRIAL MANAGEMENT
INSTRUCTION CONSULTATIONS
TRAINING INSTALLATIONS
Wood and Franklin Streets, Station 21
Pittsburgh, Pa.

ALLAN H. MOGENSEN
Training in Work Simplification
330 W. 42nd Street
NEW YORK CITY

INEFFICIENCY
with its resultant waste, plays havoc with production costs.

PROFITABLE OPERATION
is dependent upon correct plant design, management, processes, equipment and methods.

ADVICE
available through a CONSULTING ENGINEER is frequently the only necessary means of putting a plant on a more efficient production basis.

WIRE

IRON • STEEL • ALLOY

•

All Sizes and Shapes and for all purposes

•

Highest Quality and Service Guaranteed

•

Established 33 years

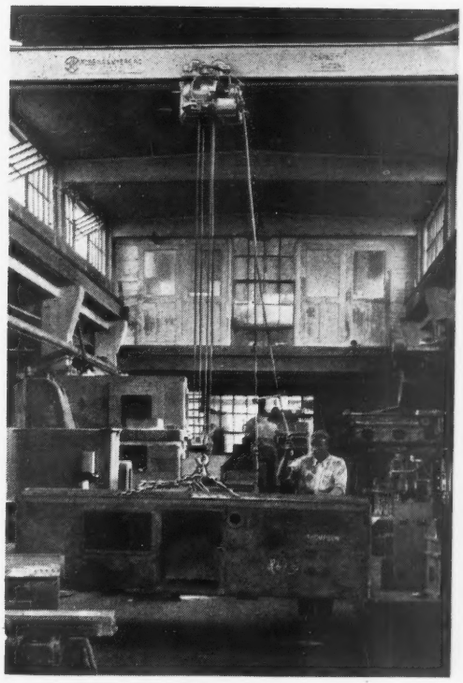
IRON STEEL ALLOY — WIRE "SENECA" — TRADE MARK

The Seneca Wire & Mfg. Company

FOSTORIA, OHIO

Representatives and Warehouses in many principal cities

SMALL... but what a worker!



Here is an R & M Crane that might save you plenty of money. It is so smooth running that one man can easily move the crane and electric hoist at good speed, with a 2- or 3-ton load. It's the modern way to handle heavy castings or heavy *anything*—and keep the procession moving!

You will be surprised at how little a crane like this costs. Let R & M engineers tackle your problem. A letter outlining it will get action—and a copy of our Crane Catalog No. 7474.

•

2-Ton R & M Hand-Push Crane—27 ft. span; 20 ft. per minute hoisting speed; 20 ft. lift.

ROBBINS & MYERS, INC.

HOIST & CRANE DIVISION • SPRINGFIELD, OHIO

Featuring additional products and specialties for manufacturing plants

WHERE TO BUY

SUPPLEMENT

Featuring additional products and specialties for manufacturing plants

LOW COST **ELECTRIC EYE Control**

PHOTOBELL

Door Attendant
Burglar Alarm
Counting Machine

Count, without touching cartons, kegs, fragile or freshly painted articles. **Smoke** alarms for boiler rooms, smokestack. **Write** for free data on **your** application.

PHOTOBELL CORP. 123 LIBERTY ST. NEW YORK CITY

ELEVATORS

Portable Elevators
Hydraulic Elevators
Traction Elevators
Ramp Eliminators
Car & Machine Loaders

LIFTRUCKS

for Skid Handling
Pallet Handling
Tin Plate, Cable reels & special purposes

Send for Complete Details

REVOLVATOR 961 State St. No. Bergen, N. J.

Buy This Genuine ½" SpeedWay Drill $24.50

At the Lowest Price ever made on a Quality Drill of this Size

- Specially Wound High Torque SpeedWay Drill Motor
- Streamlined Air Cooling Die Cast Case
- Natural Grip Direct Thrust Breast Plate Handle
- Removable Side Handle for Close Quarters
- Self Aligning Oilless Bearings
- 500 R.P.M. Operating Speed
- Smooth Sliding Thumb Switch
- Complete with hand operated 3-jaw ½" chuck, cord, plug.

SpeedWay

Write for circulars and name of nearest dealer. 1869 S. 52nd Ave., Cicero, Ill.

? *Find what you are looking for? If this or other advertising in this issue does not supply the information wanted, of products or services, write*

Factory Management and Maintenance
330 W. 42d St., New York, N. Y.

?

Est. 1878 — ORANGEVILLE — Ask for CATALOG

ALL TYPES **FLOOR TRUCKS** WHEELS CASTERS

ORANGEVILLE MFG. CO.,
Orangeville (Col. Co.) Penna.

THE PURE

PURE THREE POINT LUBRICATION
A Complete Line of Industrial Petroleum Products

THREE POINT SERVICE — PURE OIL COMPANY U.S.A.

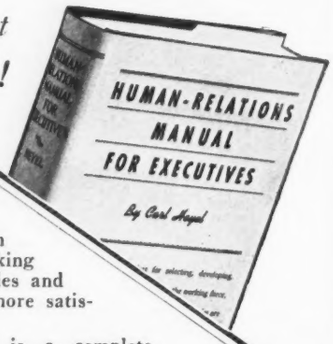
Ask a Pure Oil Engineer to help solve your lubrication problems

OIL CO.
CHICAGO U.S.A.

Put some of these ideas to work

to make your personnel happier and more efficient

Just Out!



Even a first reading of this new book ought to yield three or four ideas that you can apply right away in getting on better terms with your working force and in inducing attitudes and methods that will result in more satisfactory production.

Each of the many ideas is a complete unit in itself—chosen because it already has been used effectively by some concern, and because it is adaptable, simple, and inexpensive enough to be applied immediately by other concerns to solve a definite problem in some division of choosing, training, guiding, or dealing with employees.

HUMAN-RELATIONS MANUAL FOR EXECUTIVES

By CARL HEYEL

Manager, Conference Planning Division
American Management Association

With a foreword by Alvin E. Dodd
President, American Management Association

253 pages, 5½ x 8, $2.00

THIS book contains nearly 300 distinct ideas, methods, plans, and stunts for selecting, developing, stimulating, safeguarding, guiding, and dealing with the working force.

The ideas are classified and blended so that they constitute a good survey manual of today's trends in the principal elements of personnel management. Most of all, however, you will like the ideas themselves—each a simple, workable plan that you can put to work without expensive equipment or the advice of an expert. Look up, for instance, the suggestions entitled:

One Way to Cure Late-comers
Team Interviewing
The S.O.S. Team
Swapping Workers
How One Rubber Company Guides Its Foreman Groups
To Discourage Carelessness
Color Stimulated Neatness
Willie Everlearn
Garnishee Evil Cured
They Choose Their Own Hours

SEE THE BOOK 10 DAYS ON APPROVAL
MAIL THIS COUPON TODAY

McGRAW-HILL ON-APPROVAL COUPON

McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. C.

Send Heyel—Human-Relations Manual for Executives for 10 days' examination on approval. In 10 days I will send $2.00 plus a few cents postage and delivery, or return book postpaid. (We pay postage on orders accompanied by remittance.)

Name .....

Address .....

City and State .....

Position .....

Company .....
(Books sent on approval in U. S. and Canada only) Fac-12-39

For the stranger in our midst—

When a copy of FACTORY is handy in plant or office, a non-subscriber like you is bound to pick it up and glance through it. With benefit certainly, for there's plenty in this and every other number of value to you, if you hold a responsible position in industry.

Chance readers like you are 'strangers in our midst.' FACTORY welcomes you and hopes to be favored with your personal subscription. For your experience is valuable—the more 'strangers' that come into the fold the better for them and the present subscribers.

Because the cooperative nature of FACTORY makes every subscriber a potential contributor—there's a constant pooling of ideas and constructive comment for the benefit of all.

Chance reading of FACTORY, we repeat, is valuable as far as it goes. But just scanning a copy once in a while won't yield the full measure of practical aid that the service holds for you.

The very article that would be of immeasurable help to you might be in an issue you miss. The safe way is a personal subscription. Place it now—then you will be sure to get every single fact, figure and idea that is new and important.

FACTORY
330 West 42nd Street, New York, N. Y.

Subscription Rates—United States, Canada, Mexico, and Central and South American Countries, $3 a year. All other countries, $4 a year.

POSITION VACANT

PRODUCTION MANAGER WANTED, with mechanical engineering training and experience in production of fabricating, welding and machine shop work for firm employing between four hundred and five hundred men. Must be familiar with inspection and production control methods and cost analysis. P-624, Factory Management and Maintenance, 520 N. Michigan Ave., Chicago, Ill.

EMPLOYMENT SERVICE

EXECUTIVES AND TECHNICAL MEN. Contact employers for positions through our confidential and effective methods. We negotiate preliminary overtures. Established 24 years. Inquiries invited. H. H. Harrison, Director. The National Business Bourse, 20 West Jackson Blvd., Chicago.

POSITIONS WANTED

(See also "Representative & Salesman Available")

FACTORY MANAGER or Superintendent: Seasoned executive with practical management and engineering background, covering broad diversified manufacturing experience. Thorough knowledge of purchasing; budgets; cost analysis and reduction; product design; equipment tooling-up; materials; modern production methods: wage systems with incentives; plant upkeep; organization and labor relations. PW-622, Factory Management and Maintenance, 330 W. 42nd St., New York, N. Y.

CHIEF ENGINEER
Heavy Steel Manufacturing
Construct and Maintenance
Power and Budgets
Age — 40 — Go Anywhere
PW-606, Factory Manage. & Maintenance
520 No. Michigan Ave., Chicago, Ill.

SALARIED POSITIONS
$2,500 to $25,000

This thoroughly organized advertising service of 29 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details.

R. W. BIXBY, INC.
276 Delward Bldg., Buffalo, N. Y.

MOTION AND TIME STUDY TRAINING

The increasing acceptance of motion study, time study, and methods study by industry is creating a demand for men with specialized training in Methods Engineering. If you wish to prepare for a good position, investigate the opportunities this uncrowded field offers. Home study courses are available for the individual—personal training programs are available for industrial units. All courses are under the supervision of industrial consultants engaged and experienced in this field. Write for booklet describing these courses.

METHODS ENGINEERING COUNCIL
Wood and Franklin Streets
PITTSBURGH, (21), PENNSYLVANIA

POSITIONS WANTED

TIME STUDY POTENTIAL: Young man with eight years diversified manufacturing experience: Skilled inspection, supervision. Mechanical Engineering study at Purdue; home study. Now employed in supervision capacity. Wants opportunity develop as Methods Engineer. PW-615, Factory Management & Maintenance, 520 N. Michigan Ave., Chicago, Ill.

PLANT SUPERINTENDENT or plant manager. Familiar with all phases of modern industrial management. Now employed as plant superintendent of electrical manufacturing company employing two hundred fifty workers. Eager to make change. Age thirty-seven. PW-621, Factory Management and Maintenance, 520 N. Michigan Ave., Chicago, Ill.

COLLEGE GRADUATE, age 24; Master of Business Administration degree, Wharton, 1937; accounting and industrial management majors, high scholastic standing; stenographic and two years accounting and manufacturing experience; desires position as assistant to busy executive. Location unimportant. PW-623, Factory Management and Maintenance, 520 N. Michigan Ave., Chicago, Ill.

INDUSTRIAL ENGINEER available as Chief Industrial Engineer, Director of Training, Works Manager or Assistant. Sixteen years broad experience all phases industrial engineering. Skilled at cost reduction and labor relations. Hardware, process, non-rigid manufacturing and educational background. Protestant. Employed. PW-627, Factory Management & Maintenance, 330 W. 42nd St., New York, N. Y.

PLANT EXECUTIVE'S ASSISTANT: Graduate electrical engineer desires to locate in Connecticut. Age, 25; B.S., 1937. Experienced in plant work, particularly the purchasing, installation, and maintenance of plant equipment and materials. At present employed in large western New York manufacturing concern. PW-626, Factory Management & Maintenance, 330 W. 42nd St., New York, N. Y.

ASSISTANT WORKS MANAGER—High grade executive with twenty-five years' practical experience in analysis of manufacturing methods and operations for most economic results, departmental coordination, cost studies, and excellent experience in successful plant layouts. Engineering training and experience. At present connected in this capacity with nationally known concern. PW-628, Factory Management & Maintenance, 520 N. Michigan Ave., Chicago, Ill.

REPRESENTATIVE AVAILABLE

MANUFACTURERS ATTENTION: Very large old established London Highly rated firm, branches throughout England. Close government and industrial contacts, seeks to represent on commission basis various American factories. Will pay cash CIF American Sea Port. If you want AAA1 selling agency to secure export orders, write for details. Explain what items you can offer for export. Address, P. O. Box #3, Birmingham, Ala.

Established Sales Engineer covering New England industrial plants. Can handle additional line. SA-625, Factory Management & Maintenance, 330 W. 42nd St., New York, N. Y.

MANUFACTURING
PROCESSING — ASSEMBLING
Quality Work — Lower Prices

Denver, Colorado machine shop fully equipped to handle all types of light machine work. Equipment also includes 1500 ton coining press for hot or cold pressing. Low overhead insures attractive cost prices with quality work guaranteed. All orders promptly executed. State requirements for cost estimates. *Address:*

CW-619, Factory Mgt. & Maintenance
520 No. Michigan Ave., Chicago, Ill.

SALES ENGINEER WANTED

An aggressive Nationally prominent Manufacturer, the leader in its field, is looking for a Sales Engineer, experienced in all phases of elevator manufacturing, distribution, selling, and installation, to take charge of the elevator division of its business.

Immediate and future compensation will be commensurate with ability and results produced.

To be considered applicant must have demonstrated qualifications in elevator selling, merchandising and executive sales management and must be willing in the future to travel as conditions require.

We prefer a man between 30 and 42 years of age.

To qualify for personal interview, please give full and specific details in your first letter.

All applications are strictly confidential and no references will be approached without permission.

Address
SW-620, Factory Management and Maintenance,
330 W. 42nd St., New York City, N. Y.

N. E. Cor. LINCOLN AVE.
EAST 133rd ST.
Bronx, New York

Approx. 100,000 Sq. Ft. Adjoins Tri-Boro Bridge Approach. Heavy Mill Construction. Plot 200 x 275 x 125. Sprinkler, 3 Elevators. Can be sold in sections. Price $150,000.

EUGENE J. BUSHER CO., INC.
349 East 149th St., New York City
MOtt Haven 9-1210
Full Commission to Brokers

ELECTRICAL MACHINERY

Motors and Generators, A.C. and D.C. for sale at Attractive Prices. Large stock. New and Rebuilt. All Guaranteed. *Write for Stock List and Prices.*

V. M. NUSSBAUM & CO.
FORT WAYNE, IND.

—TRANSFORMERS—

A Complete Stock **Prompt Shipment**

3—400 KVA Gen. Electric Transformers, 60 cycle, 33000–2300/4000Y volts **$985.00** Each

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Write for Catalog No. 134D

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

RE-NU-BILT MOTORS GENERATORS TRANSFORMERS LARGE & HEAVY ELECTRIC POWER EQUIPMENT

Thoroughly Tested Before Shipment *and* Guaranteed

MORE THAN 50% SAVING

BELYEA CO. INC.
35 HOWELL STREET
JERSEY CITY, NEW JERSEY

INDEX TO ADVERTISEMENTS

	Page
Acheson Colloids Corp.	120
Acme Steel Company	153
Alemite Div. Stewart-Warner Corp.	31
Allen, Oliver Field	148
Allis-Chalmers Mfg. Co.	11, 85, 154
Amer. Mutual Liability Ins. Co.	12, 13
American Optical Co.	129
Armstrong Machine Works	137
Bakelite Corp.	141
Bijur Lubricating Corp.	122
Blaw-Knox Co.	140, 145
Bristol Co.	111
Brown Co.	18, 19
Browning Crane & Shovel Co.	120
Buffalo Forge Co.	143
Burgess Battery Co.	147
Burt Mfg. Co.	140
Carey Co., Philip	148
Century Electric Co.	139
Chesapeake & Ohio Lines	10
Chicago Eye Shield Co.	110
Chisholm-Moore Hoist Corp.	110
Clarage Fan Co.	148
Colson Corp.	130
Crane Co.	30
Darnell Corp., Ltd.	142
Dayton Rubber Mfg. Co.	89
Denison Enrg. Co.	132
De Vilbiss Co.	96
Diamond Chain & Mfg. Co.	26
Disston & Sons, Inc., Henry	23
Eagle-Picher Lead Co.	123
Edwards, A. Vanderford	148
Electric Controller & Mfg. Co.	124
Electric Storage Battery Co.	81
Electric Wheel Co.	147
Fafnir Bearing Co.	24
Fairbanks, Morse & Co.	91
Felters Co.	32
Finnell System, Inc.	134
Fleur-O-Lier Mfrs.	133
French & Hecht, Inc.	132
Garlock Packing Co.	132
General Electric Co.	83, 95, 103
G. E. Co. (Lamp Dept.)	20, 21
G. E. Co. (Mdse. Div.)	97
Goodrich Company, B. F.	3
Goodrich Electric Co.	106
Goodyear Tire & Rubber Co.	8
Graybar Electric Company	7
Grinnell Co.	27
Gulf Oil Corp.	6
Harnischfeger Corp.	126
Heating & Ventilating Exposition, 6th International	108
Homestead Valve Mfg. Co.	108
Hyatt Bearings Div. G. M. Corp.	87
Independent Pneu. Tool Co.	93
Industrial Brownhoist Corp.	145
Industrial Control Div. of Square D	3rd Cover
Invincible Vacuum Cleaner Mfg. Co.	102
Johns-Manville, Inc.	22
Johnson Gas Appliance Co.	110
Jones & Laughlin Steel Corp.	121
Kinnear Mfg. Co.	134
Koppers Co.	117, 118
Link-Belt Co.	4
Magnolia Metal Co.	145
Maple Flooring Mfrs. Ass'n.	125
Master Electric Co.	25
McCaskey Register Co.	113
McGraw-Hill Book Co.	142, 150
Methods Engrg. Council, Inc.	148
Mogensen, Allan H.	148
Morse Chain Co.	4th Cover
New Departure Div. G. M. Corp.	34
North Bros. Mfg. Co.	114
Orangeville Mfg. Co.	149
Osborn Mfg. Co.	9
Pangborn Corp.	147
Philadelphia Gear Works	105
PHILCO, Battery Division	33
Photobell Corp.	149
Pure Oil Co.	149
Revolvator	149
Robbins & Myers, Inc.	149
Rockbestos Products Corp.	109
Ryerson & Son, Inc., Jos. T.	128
Scott Paper Co.	137
Scully Steel Products Co.	115
Searchlight Section	151
Seneca Wire & Mfg. Co.	149
Service Section	149
Shepard Niles Crane & Hoist Corp.	140
Sisalkraft Co.	114
Speedway Mfg. Co.	149
Skilsaw, Inc.	28
Socony-Vacuum Oil Co.	14, 15
Square D Company	3rd Cover
Standard Oil Co. of Indiana	insert, 99, 100
Standard Pressed Steel Co.	112
Sturtevant Co., B. F.	116
Sugar Beet Products Co.	142
Synthane Corp.	2nd Cover
Taylor Instrument Co.'s	101
Texas Company	107
Thermoid Rubber Div. Thermoid Co.	119
Trico Fuse Mfg. Co.	134
U. S. Steel Subsidiaries	115
Veeder-Root, Inc.	127
West Disinfecting Co.	29
Westinghouse Elec. & Mfg. Co.	16, 17
Weston Electr. Instrument Corp.	131
Whitney Chain & Mfg. Co.	138
Wing Mfg. Co., L. J.	98
Yale & Towne Mfg. Co.	104

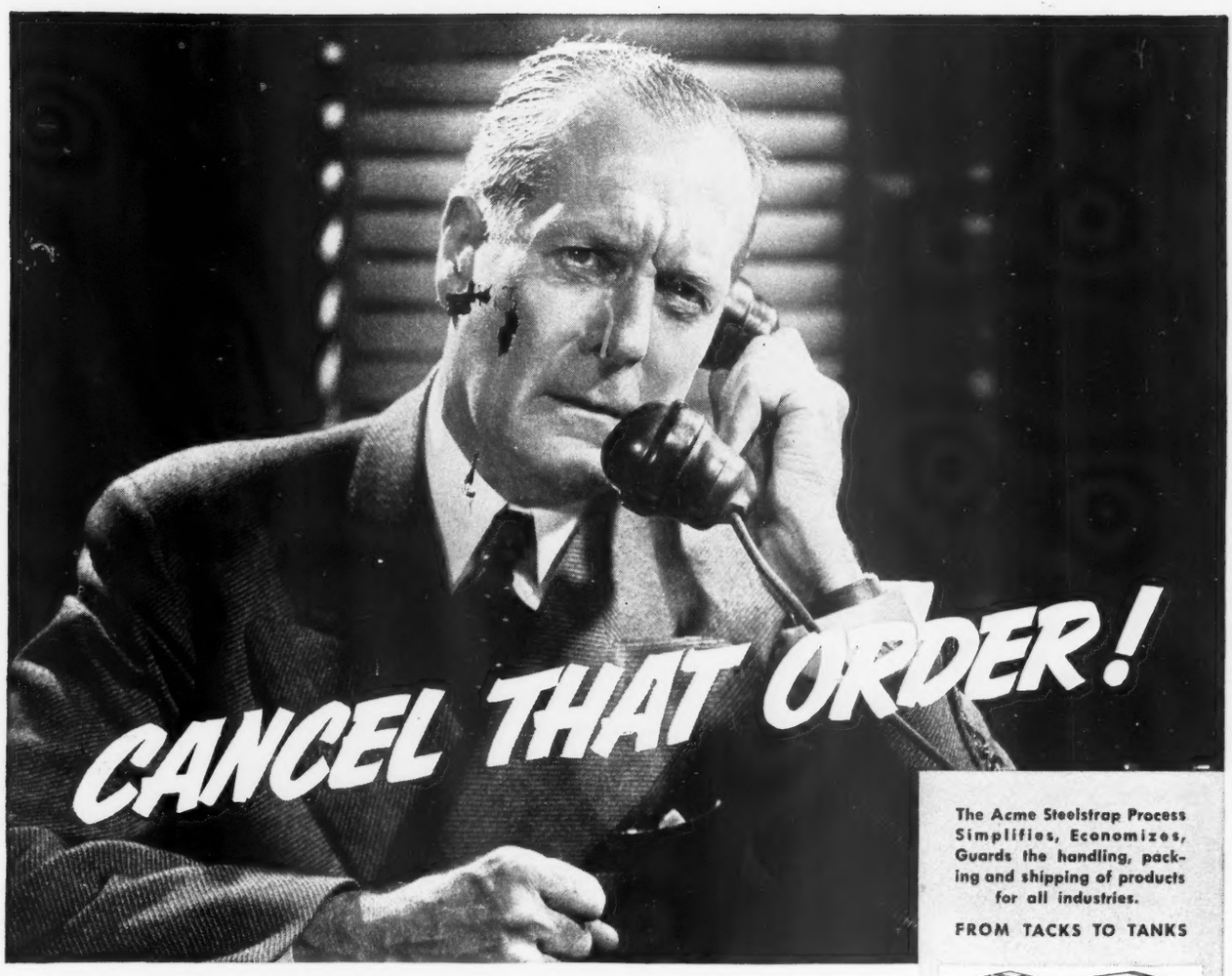
▼

INDUSTRIAL CONSULTANTS. 148

▼

SEARCHLIGHT SECTION
(Classified Advertising)

Business Opportunities	151
Contract Work	151
Employment Service	151
Factory For Sale	151
Positions Vacant	151
Positions Wanted	151
Selling Opportunities	151
Equipment New and Used	151
Belyea Co., Inc.	151
Electric Service Co., Inc.	151
Nussbaum & Co., V. M.	151



ARE YOU RESPONSIBLE FOR GIVING COMPETITORS THE *"Damaged Shipment"* ADVANTAGE?

Because *damaged shipments* frequently strain customer good will to the breaking point, they may provide just the opening for which your competitors have been waiting.*

This danger can easily be eliminated—shipments of all kinds can be fully protected, by utilizing a scientifically developed packing and shipping process.

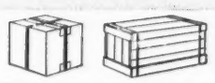
The Acme Process is being applied by thousands of concerns to assure safety and at the same time to *lower packing and shipping costs.* An Acme Analysis discloses the "profit leaks" as well as the packing weaknesses. The analysis will show how adequate protection can be obtained and the amount which can be saved per unit or per shipment by the correct use of Acme Steelstrap or Acme Unit-Load (for carload and l.c.l. bracing).

Write for an analysis of *your* packing and shipping procedures—be sure that you're not giving your competitors an unnecessary shipping advantage.

***Last year the damage claims reported by one type of carrier, alone, amounted to more than twenty-one million dollars.**

The Acme Steelstrap Process Simplifies, Economizes, Guards the handling, packing and shipping of products for all industries.

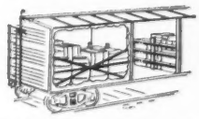
FROM TACKS TO TANKS



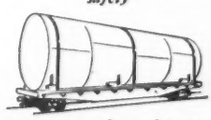
Reinforces cartons, boxes and other small unit shipments

Facilitates handling of bulky, heavy or hard-to-handle products

Combines many individual units into one large easy-to-handle pack



Eliminates unnecessary carload bracing, yet assures maximum safety



Easily secures huge shipments and odd shapes

ACME STEEL COMPANY
ACME *Steelstrap* PROCESS
2831 ARCHER AVE. • CHICAGO, ILL.

ACME STEEL COMPANY
2831 Archer Ave., Chicago, Ill.
☐ Mail a copy of the new booklet "Stopping Profit Leaks Beyond the Production Line."
☐ Have an Acme Analyst call.

Name.....
Address.....
City.....*State*.....

LESS COST, LESS SPACE MORE GALLONS!

Three BIG Reasons Hundreds of Plants are Switching to Allis-Chalmers Extra-Value SSUnit Pumps!

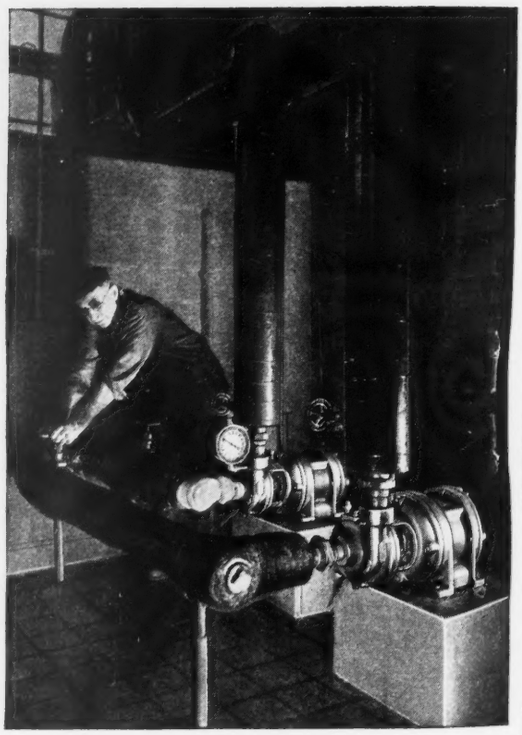
The little pump with the big money-saving performance . . . that's what men in the field say about the sensational SSUnit Pump! And here are the three big reasons they're switching to this low-cost motor-coupled pump . . . originated by the same Allis-Chalmers engineers who designed and built the gigantic turbines at Boulder Dam and Niagara Falls.

LESS COST! Simple design cuts first cost to a new low! Enclosed runner, wearing rings, and shaft sleeves are made of bronze — no chance for rust or excessive wear that runs up maintenance costs! SSUnit Pumps are completely tested before delivery . . . no wasted time or effort . . . they go to work for you the minute they're installed!

LESS SPACE! They set new records for compactness . . . these husky SSUnit Pumps! And they'll operate vertically or practically any way you want them to. That means you can save valuable space in your plant!

MORE GALLONS! You get more gallons with SSUnit Pumps because you get more efficient operation. Actual results in the field prove that new SSUnit Pumps in many cases give more than a 15% greater supply of water than older types of pumps . . . and that more water means more power dollars saved!

But you don't stop there! For coupled to the SSUnit pump is the famous Allis-Chalmers Lo-Maintenance Motor . . . the motor that has proven performance records of beating conditions that many times wreck ordinary motors in a few weeks. There's no "buck-passing" . . . Allis-Chalmers accepts full responsibility for both motor and pump!



PUMPING BRINE IN REFRIGerating system of a large county institution, this SSUnit Pump takes less space, costs less, gives more gallons!

Call the nearest district office today . . . or write direct to Allis-Chalmers. That's the way to get started on real pump savings!

1084

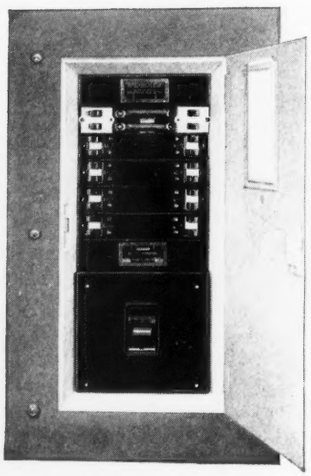
CENTRIFUGAL PUMP DIVISION

ALLIS-CHALMERS

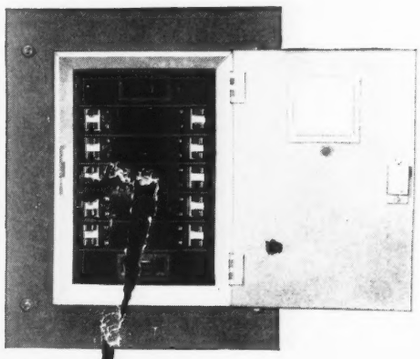
MILWAUKEE·WISCONSIN

90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

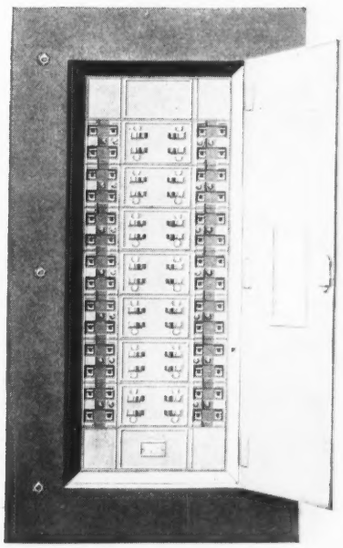
A SQUARE D PANEL BOARD FOR EVERY TYPE OF INDUSTRIAL OR COMMERCIAL BUILDING



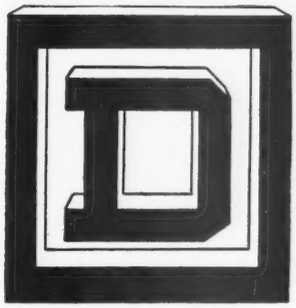
Multi-breakeR Lighting Panelboard with main circuit breaker.

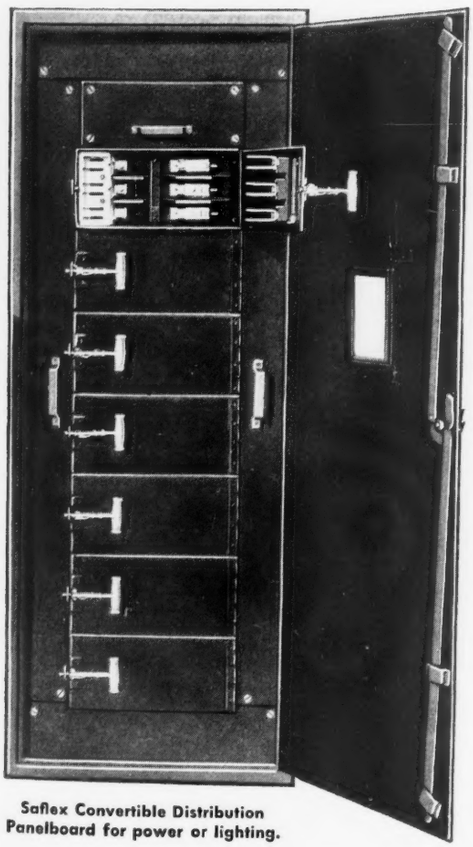


Multi-breakeR Panelboard for lighting and appliances.



Fusible Lighting Panelboard.



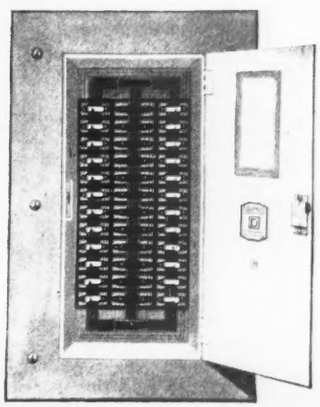


Saflex Convertible Distribution Panelboard for power or lighting.

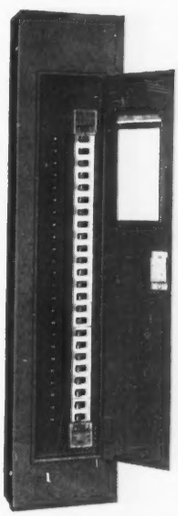
Adequate power and lighting distribution is essential to the modern industrial plant or commercial building. The Square D line of panelboards is complete. It meets every requirement.

Fusible or circuit breaker panelboards; narrow type panels for mounting in I-beams or on columns; the new Multi-breakeR panelboards which provide branch circuit switching and circuit breaker protection at a new low cost.

Square D electrical equipment is available through electrical wholesalers everywhere.



Circuit-breaker Panelboard Type L, quick make, quick break, double break branches.



Multi-breakeR Panelboard Narrow Column Type LX.

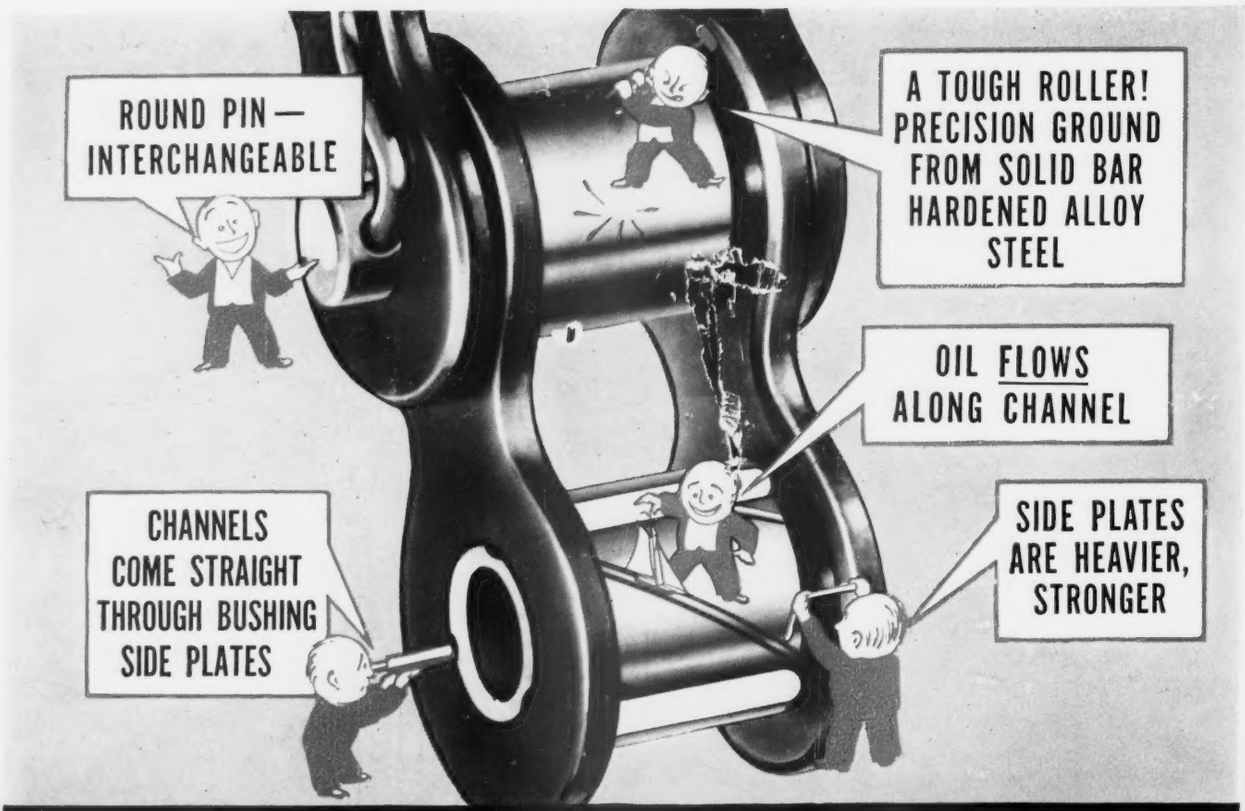
CALL IN A

SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

SQUARE D MAN



MORSE ROLLER CHAIN . . . *interchangeable channel lubricated* . . . greatest roller chain advance in a decade

NOW . . . Morse Roller Chain. A chain with a built-in lubrication system in every link, and which is completely interchangeable with every other standard roller chain. It's just what the engineers ordered.

The Morse Roller Chain puts the protection of assured lubrication right where it is most needed—and where conventionally designed roller chains most often fail—on the bearing surface of pins and bushings. Oil on the rollers of the Morse Roller Chain quickly finds its way to the spaced channels on the bushing face, flows through the side plates and down to the pin, where capillary action takes charge and spreads a protective film over the whole pin surface.

Positive lubrication makes for longer life. Here are other features which mean economical, trouble-free operation: huskier side plates mean tighter pins and bushings, making Morse Roller Chains comparable in strength to "heavy series" in other types; rollers are ground from solid bar hardened alloy steel; Morse patented spring cotter, available at no extra cost, is fast against all vibration and will not chew.

Let the Morse man in your territory tell you all about them—or write direct to Morse, Ithaca.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS KELPO CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.